The Electrical Industry's Weekly Magazine October 5, 1959

Electrical World

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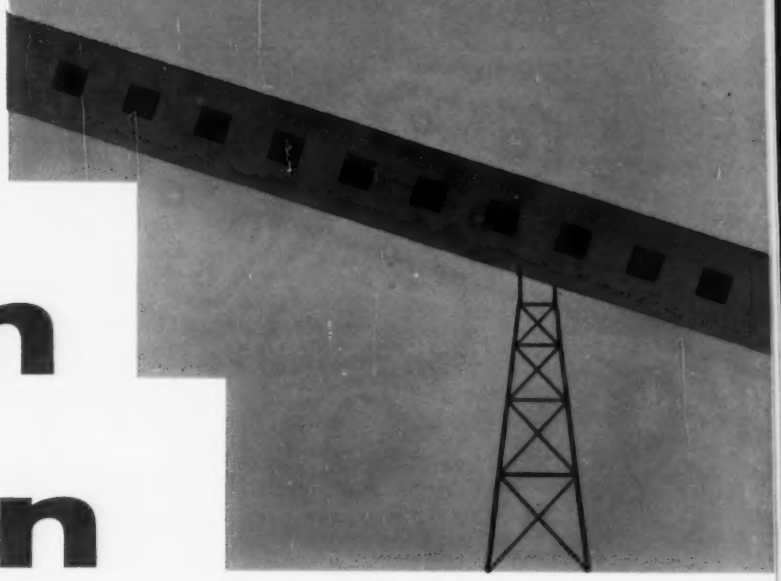

11th Steam Station Cost Survey

. . . pages 71-86

Fuel Prices to Drop as Utility Helps Create Shipping Firm...

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Do Federal Regulatory Agencies Need Revamping?

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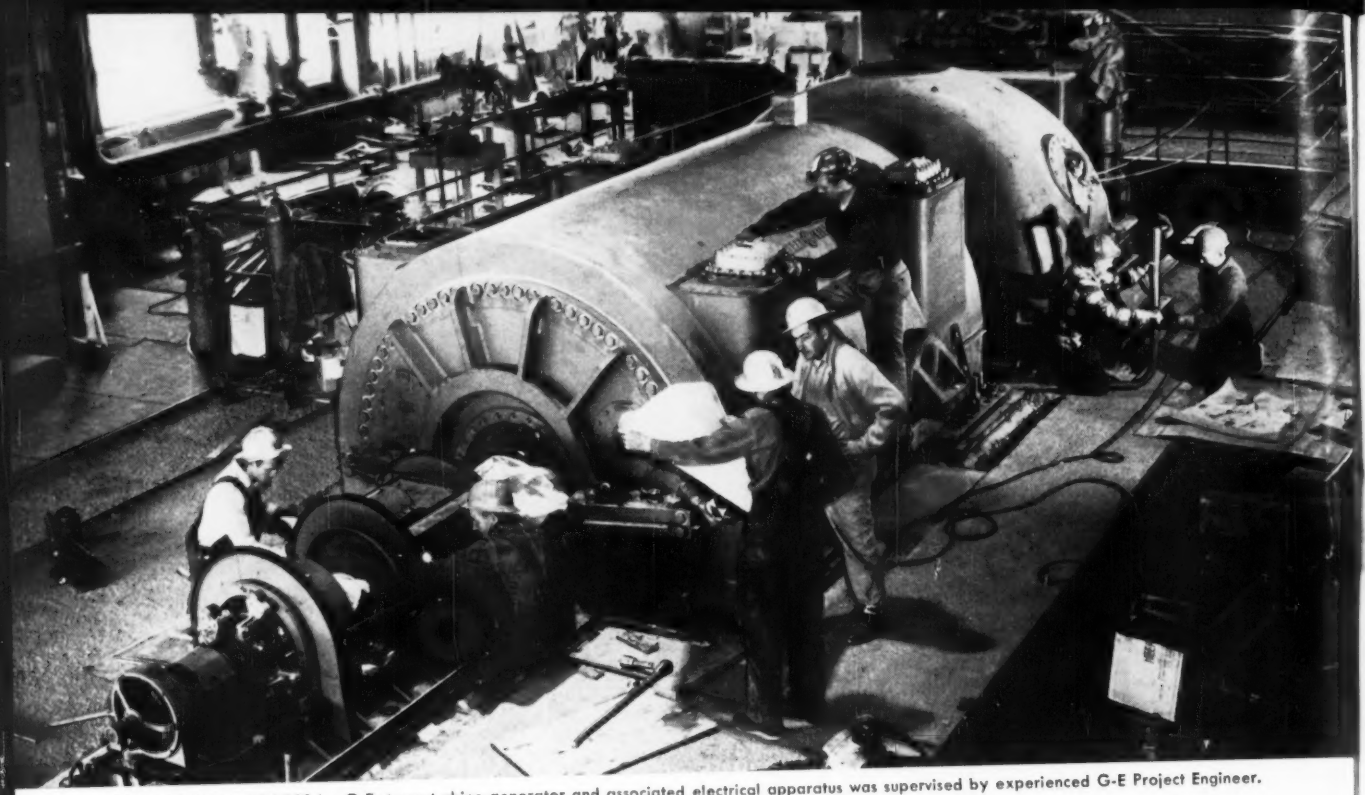

INSTALLATION of 16,000-kw G-E steam turbine-generator and associated electrical apparatus was supervised by experienced G-E Project Engineer.

Upper Peninsula Power Co. meets area growth with new 16,000-kw John H. Warden Station

G-E engineers team with Stone & Webster Michigan, Inc., to expedite final start-up

Latest chapter in the forward-looking construction and modernization program of Upper Peninsula Power Co. is the 16,000-kw John H. Warden Station at L'Anse, Michigan. Designed to help satisfy existing power needs of industrial and residential customers in the utility's service area, this new station will also provide surplus power for anticipated growth.

When Upper Peninsula Power Co. and Stone & Webster Michigan, Inc., selected General Electric turbine-generator and major auxiliary apparatus exclusively for the John H. Warden Station, their decision brought with it full advantages of G-E engineering teamwork. From preliminary design stages through final start-up, G-E engineers assisted in keeping costs down and in meeting project schedules. During the course of the project, General Electric engineers coordinated design, manufacture and delivery of the turbine-generator and all major electrical apparatus, and provided technical supervision of installation of this equipment at the site. This coordination and cooperation between the two organizations were important factors in the completion of this project on schedule and at a favorable cost.

301-407

MORE POWER TO AMERICA

GENERAL ELECTRIC

THOROUGH PLANNING simplified project construction. Stone & Webster's H. B. Follum, A. J. Seaburg, H. N. McCampbell, R. S. Hopping; G.E.'s L. E. Crane check station plans.

UTILITY serves 11 counties in Upper Peninsula. Above: Mr. J. H. Warden, President, Upper Peninsula Power; G. A. Pillmore, G.E.; W. Veeser, Upper Peninsula Power; C. M. Chumbley, G.E.

Electrical World

Vol. 152, No. 14 OCTOBER 5, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

CURRENT EVENTS

Revamp Regulatory Agencies, Hector Says

Recently resigned CAB member criticizes static scope during era of changing business conditions.....p 62

DISTRIBUTION

Capacitors Are Today's Best Buy

W. G. Hart, General Electric Co

At present prices, they can save the utility industry money in both system investment and operating costs.....p 70

SUBSTATIONS

Sealed Transformers Do the Job

G. R. Deinema, Northern States Power Co

Power units with welded covers give Northern States Power satisfactory use, without maintenance, over a decade.....p 66

Special Report

Eleventh Steam Station Cost Survey

Here is the cost and performance data for 55 new power plant installations. You'll find that these modern steam power plants cost less to build in 1958, and produced electrical energy at a lower cost than the ones covered in our 1957 survey. Although fuel costs have risen, the use of higher pressures and temperatures, use of reheat, and installation of larger units have significantly improved heat rates .....p 71

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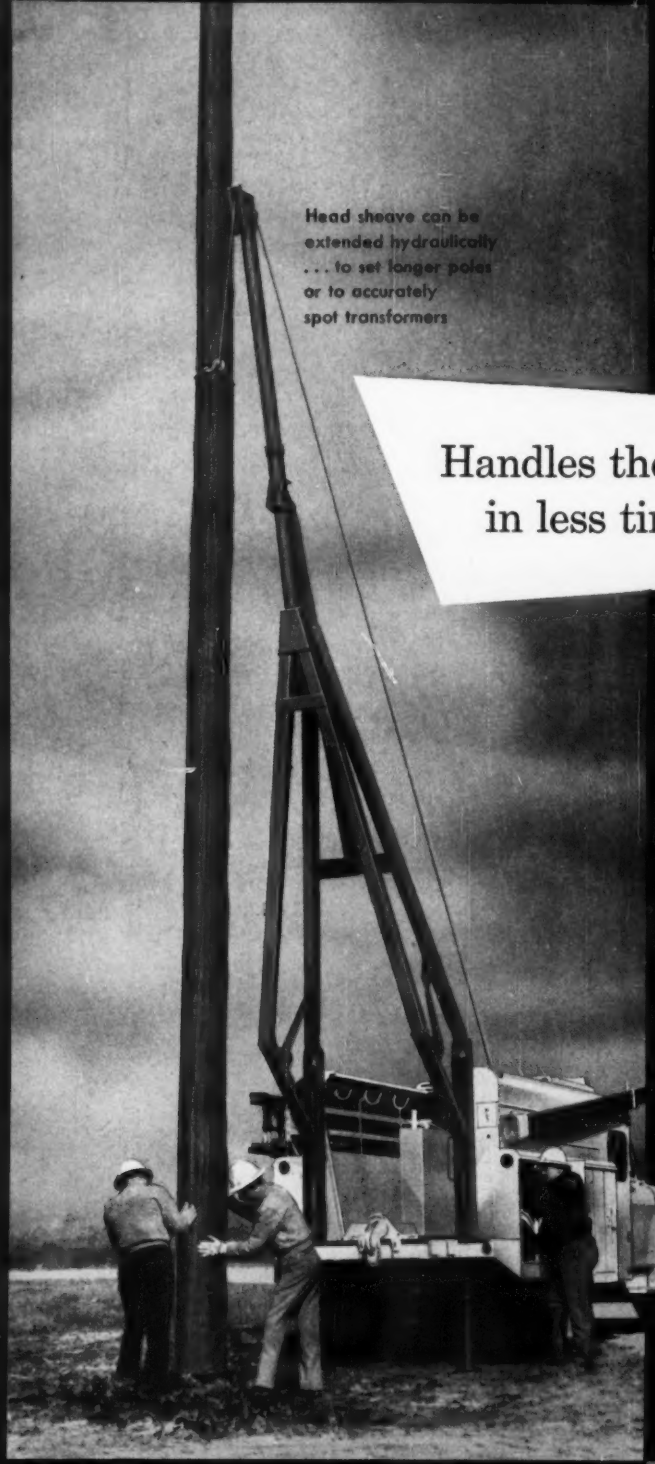

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LETTERS

"Owling" Is Not Howling Success

To the Editor:

In your June 22 issue of Electrical World on page 59 you had an article on "life-size papier-mache owls" used to frighten pigeons away from tower lines and the like.

Could you please advise us to whom we may go to secure additional information related to possible purchase and use of such a device.

Your prompt attention will be appreciated.

C. H. Gundersdorff, Jr.
Assistant Purchasing Agent
Baltimore Gas & Electric Co
Baltimore 3, Md.

To the Editor:

. . . We are interested in any further information you might have on the article "An 'Owling Success" and would greatly appreciate the forwarding of any additional information to us.

C. F. Wetzel
Commonwealth Edison Co
Ridgeland Station
Stickney (Berwyn P. O.), Ill.

The papier mache owls used at McNary Dam to frighten the pigeons were purchased from the Horners Corp, Waseca, Minn., a sporting goods firm. These fake birds were used originally at wild game farms to keep out unwanted birds. Cost is $5 each.

However, there is an important postscript to our story. The initial reaction of the worrisome pigeons was to flee from the suspended papier mache owls. But they did not leave the general area of the dam structure and after awhile the smart pigeons appeared to get wise to the scheme. Anyway, they are back again doing pretty much as they please. The fake owls still scare away some of the smaller birds.

COMING NEXT WEEK . . . Nuclear Power Group's 180 Mw Dresden station approaches criticality . . . Zig-zag structure, a six-position 230-kv steel design, cuts material, installation costs at substation soon to be energized . . . Plant serving downtown network is revamped for standby operation . . . 480-v spot network is found economic for Commonwealth Edison.

AND EVERY WEEK . . . the highly read Management Newsletter section which brings you late developments and solid, useful background for many areas of management decision.

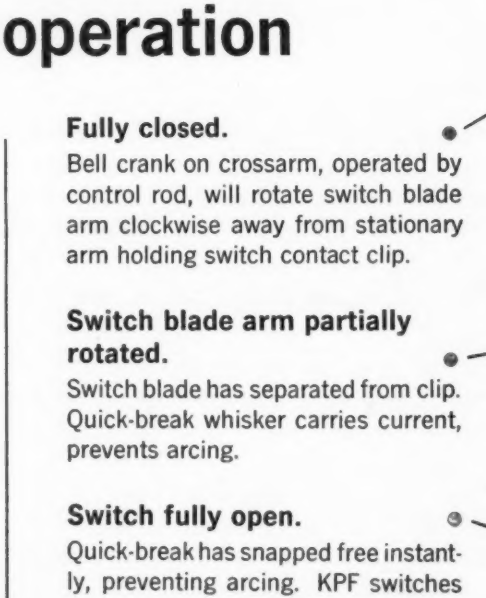
KPF switches

Trouble-free Simplicity

of design, of operation

INSTALL KPF switches more quickly on hot or dead lines, at less cost. Just bore holes in crossarms, mount phase units, connect conductors. No precision requirements, no heavy extra mounting structures, no temperamental complex mechanism to bind, freeze, malfunction or need lubrication.

Rugged, lightweight KPF switches have proved their dependability and economy in half a century of major utility service. Make a test installation on your system—this month.



Fully closed.
Bell crank on crossarm, operated by control rod, will rotate switch blade arm clockwise away from stationary arm holding switch contact clip.

Switch blade arm partially rotated.
Switch blade has separated from clip. Quick-break whisker carries current, prevents arcing.

Switch fully open.
Quick-break has snapped free instantly, preventing arcing. KPF switches operate smoothly despite icing, crossarm warpage; never need lubrication.

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AIR BREAK SWITCHES
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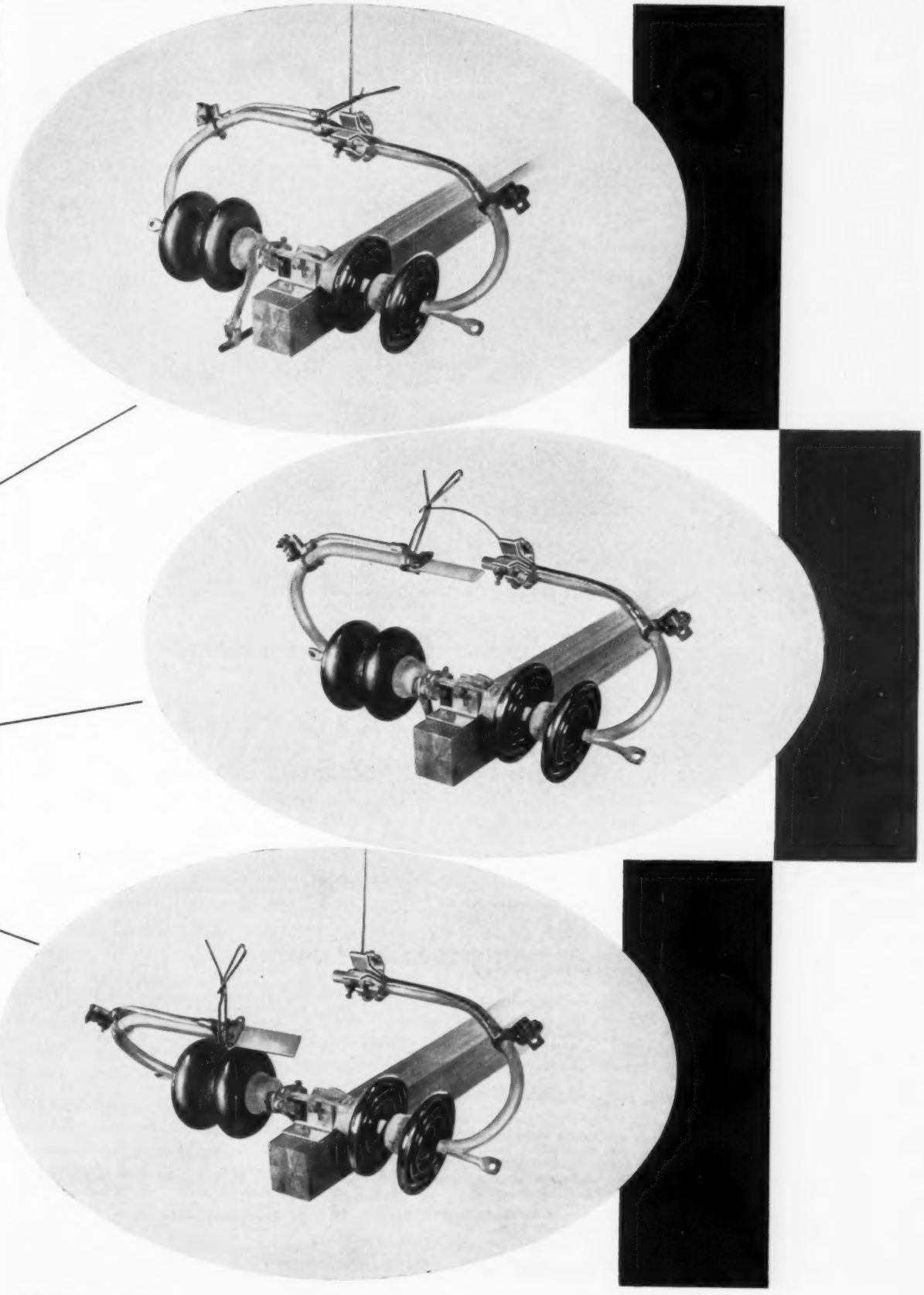


Ingersoll-Rand Steam Condenser Serves

AXIAL-EXHAUST turbine

at MECO's Portland Station

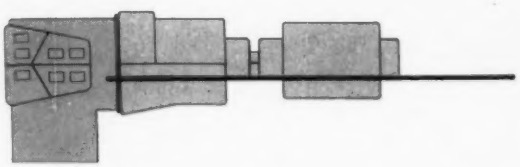
METROPOLITAN EDISON COMPANY'S new 165,000-kw Portland Station, designed and built by Gilbert Associates, Inc., features many advances in central station design—including the Ingersoll-Rand 80,000 sq. ft. surface condenser shown above.

To meet the unusual requirements of the axial-exhaust turbine and Monotube boiler, the condenser design incorporates the following features:

- Straight-through, horizontal steam path engineered for minimum friction and maximum pressure recovery . . . higher cycle efficiency.
- Reversible single-pass counter-flow cooling water circuit, convertible to two-pass operation.
- Hotwell storage of 16,000 gallons of deaerated condensate.
- Condenser is designed to receive steam by-passed from the Monotube boiler and features a built-in attemperating device.
- Welded tube ends prevent any possibility of feedwater contamination.

The Ingersoll-Rand condenser auxiliaries include circulating pumps, condensate pumps and air removal equipment consisting of two mechanical vacuum pumps with primary air-jet boosters. (Compressed air for soot-blowing and instrumentation is produced by Ingersoll-Rand compressors.)

For full details on this advanced condenser design, send for a copy of "The Condenser at Portland," Form 9306.



Simplified drawing of the Ingersoll-Rand 80,000 sq ft surface condenser connected to the axial exhaust turbine.

Ingersoll-Rand

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Weather Protected to Serve Longer

Like the postman, neither rain nor snow, nor hail, nor salt spray can prevent R T & E Transformers from doing their duty. Here's proof that every R T & E unit is completely "WEATHER PROTECTED."

- **FINISH:** Three coats of modified Alkyd paint for all season protection.
- **DESIGN:** Domed cover for immediate water run-off.
- **TANK:** Arc-welded seams and absence of lip on tank bottom mean no moisture collecting cracks and crevices.
- **BUSHINGS:** HV bushings internally clamped — no external clamps and bolts to corrode.

Plus stainless steel cover band to eliminate corrosion on accidentally scratched areas . . . stainless steel threaded mounting pads . . . all unpainted fittings either galvanized or electro-tinned.

R T & E "Weather-Protected" Transformers last longer, require less maintenance, serve better all year 'round.

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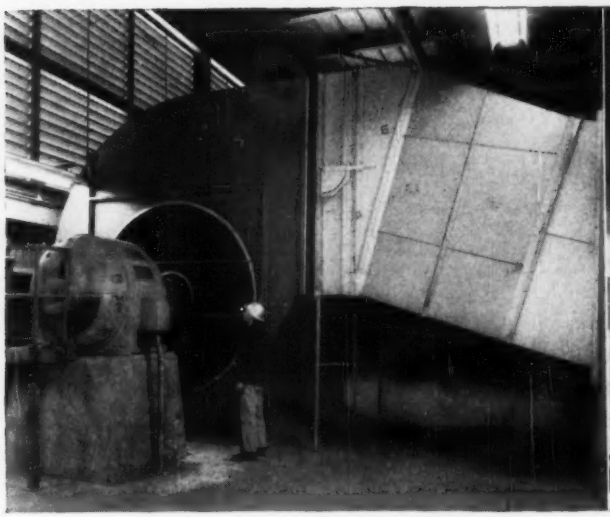
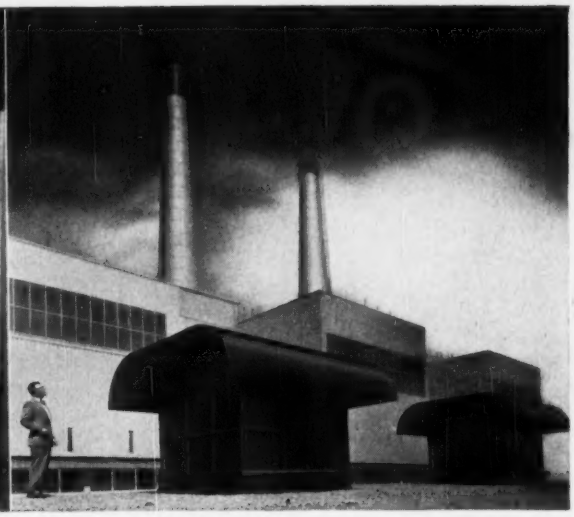
How do you plan to ventilate and heat your power plant?



WITH CENTRIFUGAL FANS?



WITH POWER ROOF VENTILATORS?

Both methods have their advantages. The type fan you select will naturally depend on the circumstances encountered in the layout of your station. To meet these requirements, "Buffalo" offers power roof ventilators, centrifugal fans and make-up air units well suited to the task. Above are two typical "Buffalo" boiler room and turbine room ventilation installations.

"Buffalo" Centrifugal Fans — These quiet, efficient, non-overloading fans have proved an excellent choice for boiler house ventilation. If desired, hot air may be ducted to other areas as needed. "Buffalo" Centrifugal Fans provide completely stable performance from free delivery to shutoff. Turbulence is reduced to a minimum by unique "Buffalo" design features. All wheels are factory-balanced to minimize vibration. Rugged construction throughout gives a long life of trouble-free service. Write for full details in Bulletins F-104 and F-201.

"Buffalo" Power Roof Ventilators — These dependable "packages" exhaust high volumes of hot air from large areas. They save money from the start, because little, if any, expensive duct work is required. Peak-efficiency "Buffalo" fans insure minimum operating costs. Installation does not interfere with valuable floor space. "Buffalo" Sky-Vent Power Roof Ventilators are complete units, quickly and easily installed. Capacities 1,000 to 250,000 CFM. Assembled packages include fan, motor, housing, roof curbing, stack and hood. Can also be arranged for supply with heating coils and dampers. Write for Bulletin FM-2345.

Your nearby "Buffalo" engineering representative will be glad to work with you on your boiler room ventilation problems. Phone him today, or write us direct.

"Buffalo"

BUFFALO FORGE COMPANY Buffalo, New York
Buffalo Pumps Division, Buffalo, N. Y.
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PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4
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BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

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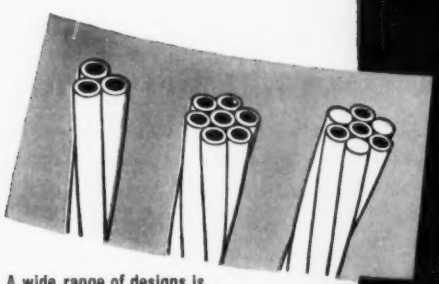

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a controlled **atomic weld**

Give your transmission lines positive and permanent protection with the new light-weight, low-cost Alumoweld Overhead Ground Wire. It's the only aluminum-covered steel wire with a thick cladding of aluminum and the only one made by the controlled atomic-weld process.

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In Alumoweld Overhead Ground Wire, you get three important benefits. (1) Its thick aluminum covering permanently protects the high-strength steel core against corrosion. (2) The electrical conductance is excellent for relaying and for discharging lightning and transient currents to ground. And, (3) Alumoweld's high strength permits stringing for ample mid-span clearance. Together, these add up to long-life protection and reduced service interruptions for your transmission lines.

For more information, write today for Engineering Bulletin E.D.3000.

ALUMOWELD

PRODUCT OF COPPERWELD STEEL COMPANY, WIRE AND CABLE DIVISION, GLASSPORT, PA.

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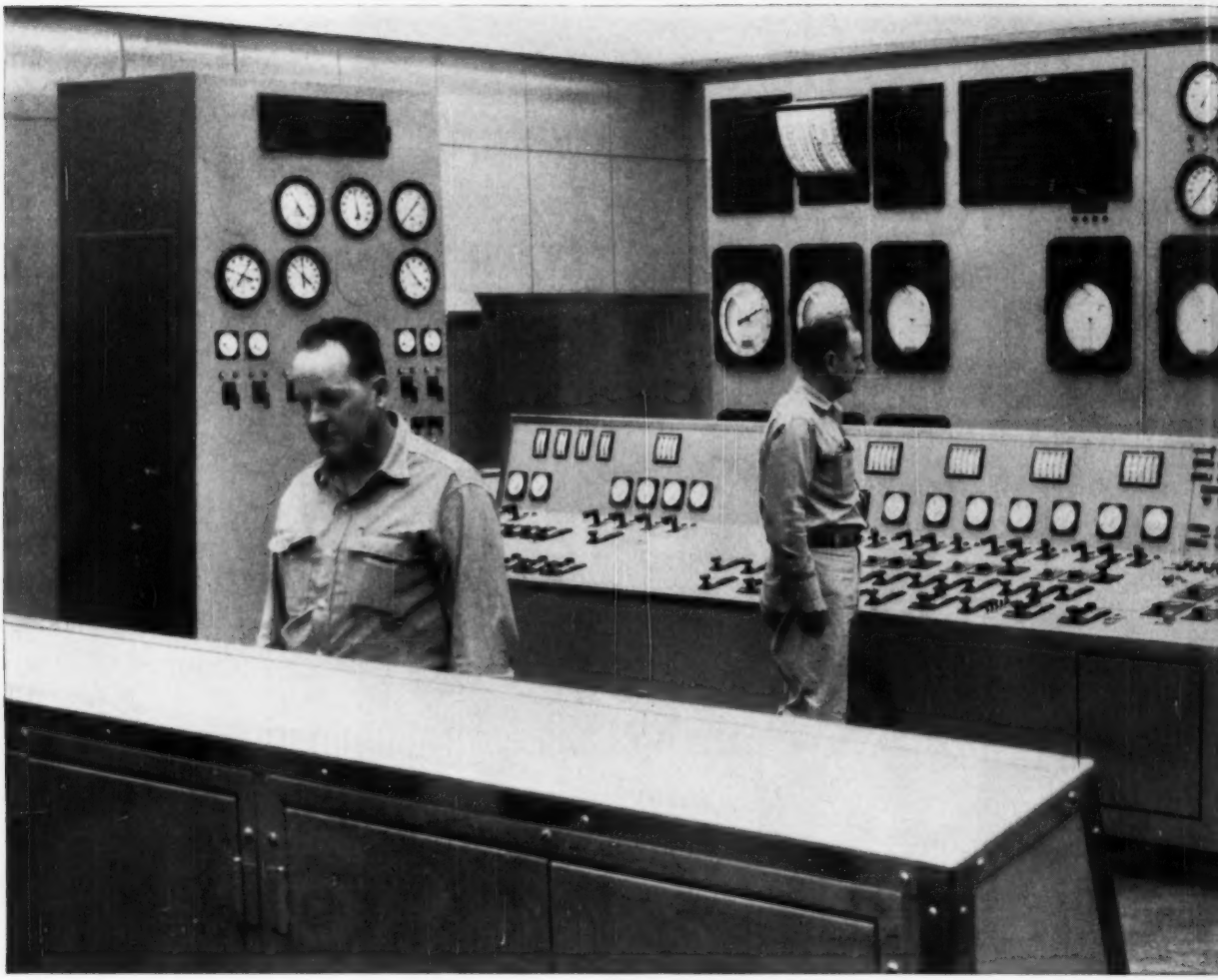


13 of 15 "most efficient"* power plants

Year after year you'll find Bailey Meters and Controls keeping sensitive fingers on the pulse of America's *most efficient* power plants (as rated by the Federal Power Commission).

According to the latest box scores, 10 of the top 15 used Bailey equipment exclusively. There must be a reason. There is. In fact, several:

1. Experience

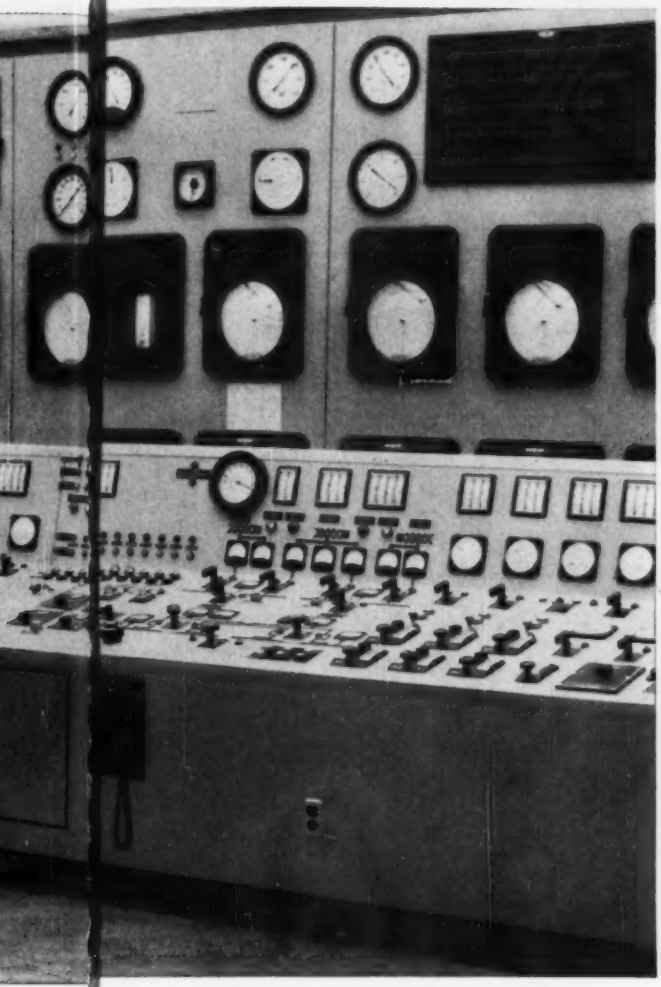
Bailey Engineers have been making steam plants operate efficiently for more than forty years. Veteran engineers and new engineers (the men who represent Bailey) are storehouses of knowledge on measurement and control. They bring you the latest, up-to-the-minute developments that can be applied to your problem.

2. Complete Line of Equipment

Bailey manufactures a complete line of standard, compatible pneumatic and electric metering and control equipment that has proved itself. Thousands of successful installations, involving problems in measurement, combustion and automatic control, are your assurance of the best possible system. You can be sure a Bailey Engineer will offer you the right combination of equipment.

3. Sales and Service Convenient to You

There's a Bailey District Office or Resident Engineer close to you (listed under Bailey Meter Co. in your phone book). Phone for expert engineering counsel.



Bailey Controls for combustion, feed water and steam temperature at the Bay Shore Station of The Toledo Edison Company. The FPC reported a 1957 heat rate at Bay Shore of 9,210 Btu per kwhr, making it one of the 15 most efficient plants in the United States.

depend on Bailey Meters and Controls

✻ 15 MOST EFFICIENT PLANTS 1957 Heat Rates Reported by the Federal Power Commission

	Btu/kwhr	Meters	Comb. Control	Feed Water Control	Supht. Control
1. Kanawha River (Appalachian Electric Power Co.)	9,118	B	B	B	B
2. Muskingum River (The Ohio Power Co.)	9,139	B	B	B	B
3. River Rouge (The Detroit Edison Co.)	9,140	—	—	—	—
4. Clifty Creek (Indiana-Kentucky Electric Co.)	9,147	B	B	B	B
5. Tanners Creek (Indiana and Michigan Electric Co.)	9,180	B	B	B	B
6. Kyger Creek (The Ohio Valley Electric Corp.)	9,201	B	—	B	B
7. St. Clair (The Detroit Edison Co.)	9,210	B	B	B	B
8. Bay Shore (The Toledo Edison Co.)	9,210	B	B	B	B
9. G. G. Allen (Duke Power Co.)	9,349	B	B	B	B
10. John Sevier (Tennessee Valley Authority)	9,350	—	—	—	—
11. Phillip Sporn (Central Operating Co.)	9,370	B	B	B	B
12. Milliken (New York State Electric and Gas Co.)	9,371	B	—	B	—
13. Shawville (Pennsylvania Electric Co.)	9,396	B	—	—	B
14. El Segundo (Southern California Edison Co.)	9,467	B	B	B	B
15. Colbert (Tennessee Valley Authority)	9,490	B	B	B	B

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Instruments and controls for power and process

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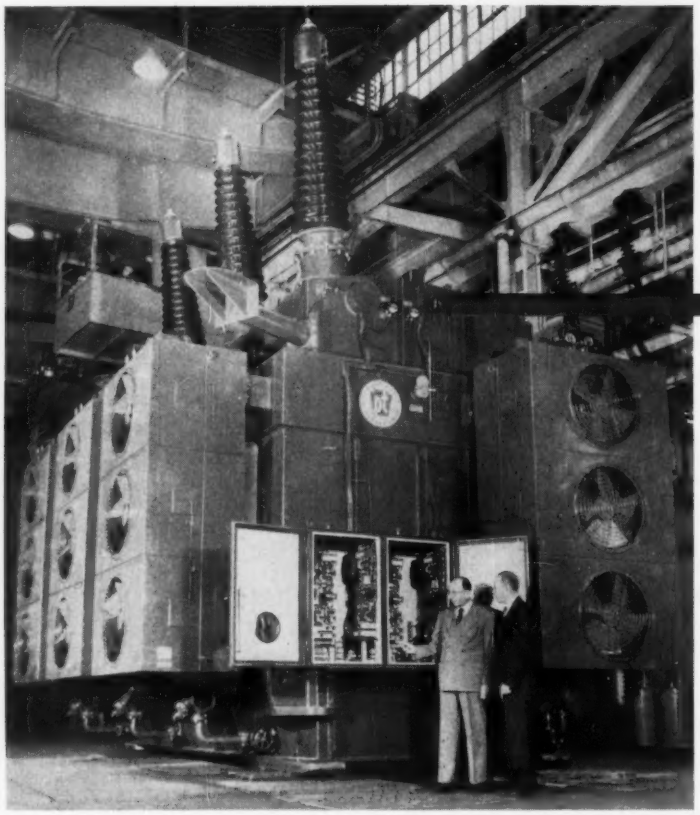
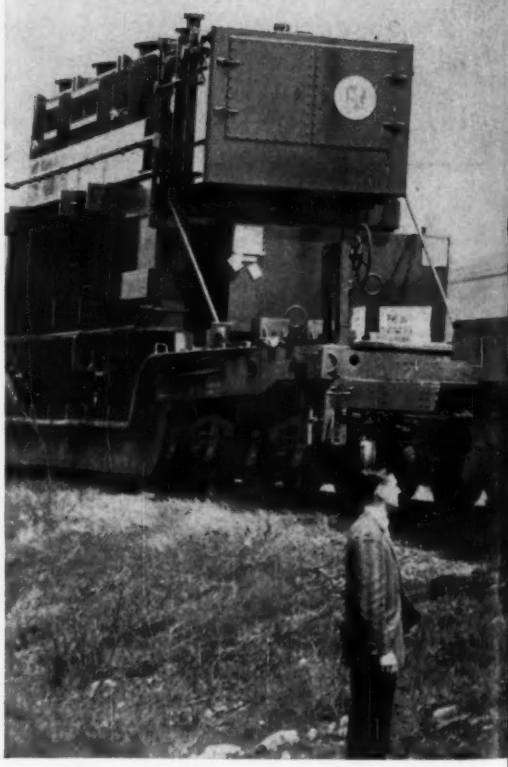


315,

...OUR BIGGEST TO DATE



We at Pennsylvania Transformer Division, McGraw-Edison Company want you to be aware of our ability to meet the largest power transformer requirements. Our advertising frequently calls attention to this ability by picturing plant facilities, just-completed large power transformers, and installations of our transformers at generating stations.

This time our production department (bless 'em!) has helped dramatize our story by completing two large Contour Design shell-form transformers—totaling 465,000 kva—within a few hours of each other. While this sort of close scheduling is not exactly routine, it is noteworthy that both transformers went through the plant on a "work-as-usual" basis with no overcrowding or taxing of facilities.

The transformer on the righthand car—the largest Pennsylvania has ever made from the standpoint of capacity—is a 315,000-kva main step-up generating station transformer for a midwestern utility. High voltage: 230,000 GrdY/132,800 volts. Low voltage: 17,200 △ volts.

The transformer on the lefthand car—destined for an eastern utility—is a 150,000-kva load tapchanging transformer. High voltage: 220,000 GrdY/127,000 volts. Low voltage: 69,000 GrdY/39,800 volts, with LTC equipment for plus or minus ten percent regulation in 32 steps of $\frac{5}{8}$% each. Tertiary voltage: 13,800 △ volts.

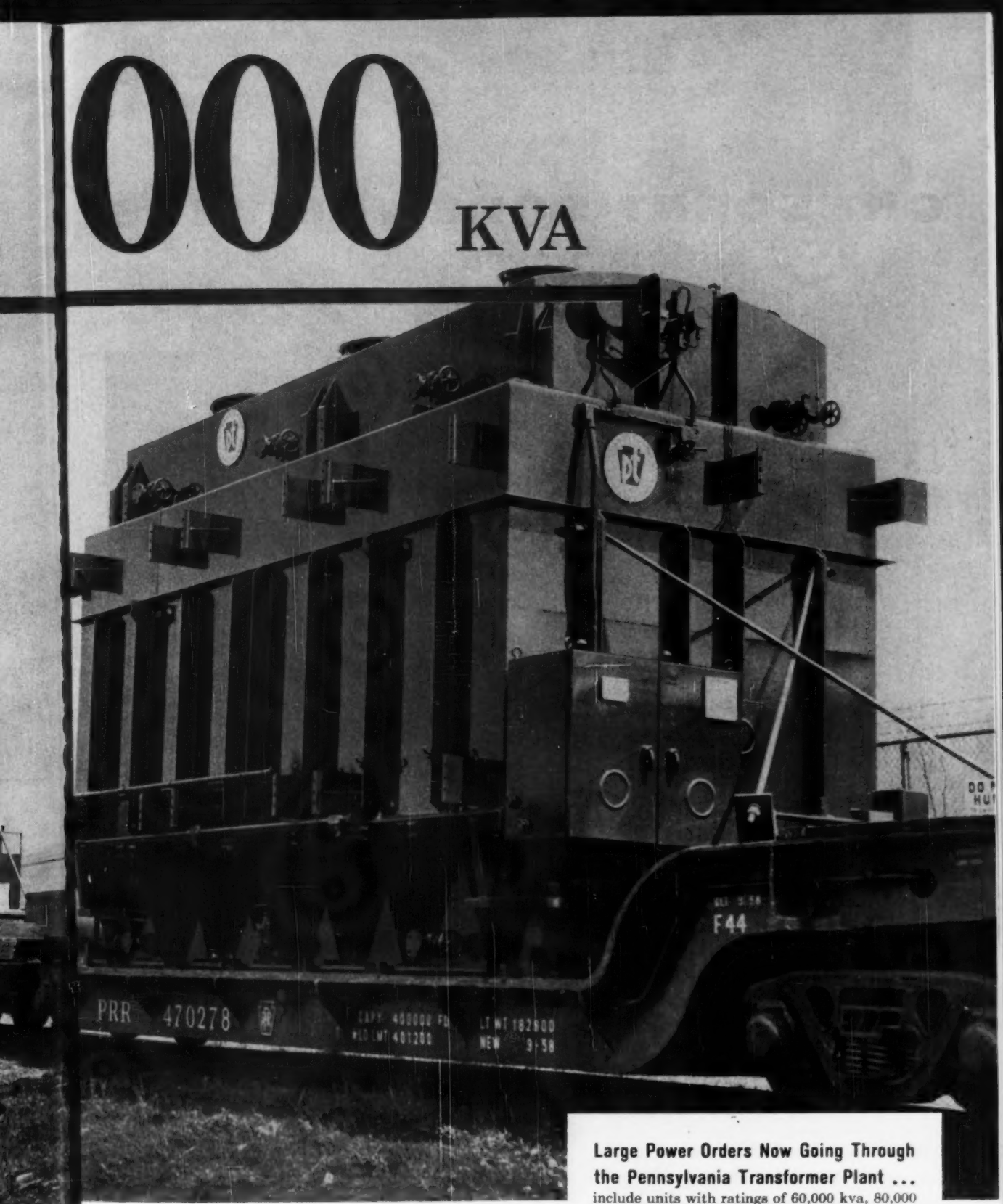
We'd like to quote on *your* next power transformer needs. Large or small . . . with or without LTC . . . shell-form or core-form, we have the facilities and the experience to meet your most exacting requirements. Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA POWER

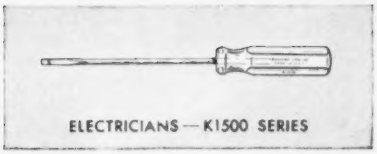
000 KVA



Large Power Orders Now Going Through the Pennsylvania Transformer Plant ...

include units with ratings of 60,000 kva, 80,000 kva, 100,000 kva and 260,000 kva. All are scheduled for completion within approximately one month. In addition, Pennsylvania is preparing to build a 460,000-volt transformer for an eastern utility company's forthcoming experimental transmission lines.

TRANSFORMERS



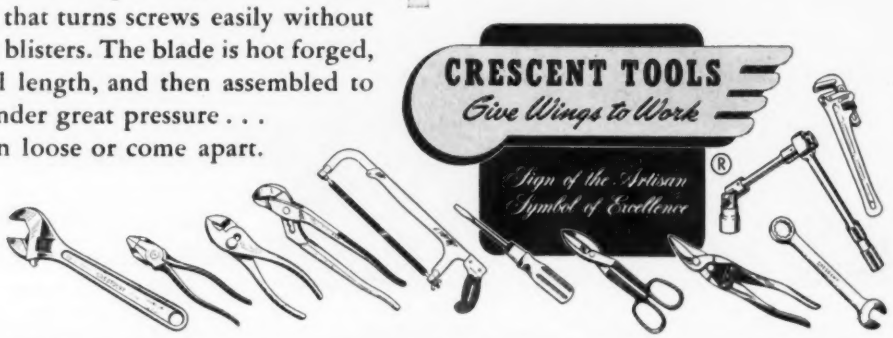
CRESCENT SCREWDRIVERS

with improved Blue Tenite Handles

Only in Crescent do you get this combination of handle and blade superiority. The improved Tenite handle provides a firm, comfortable grip that turns screws easily without causing hand blisters. The blade is hot forged, hardened full length, and then assembled to the handle under great pressure . . . it cannot turn loose or come apart.

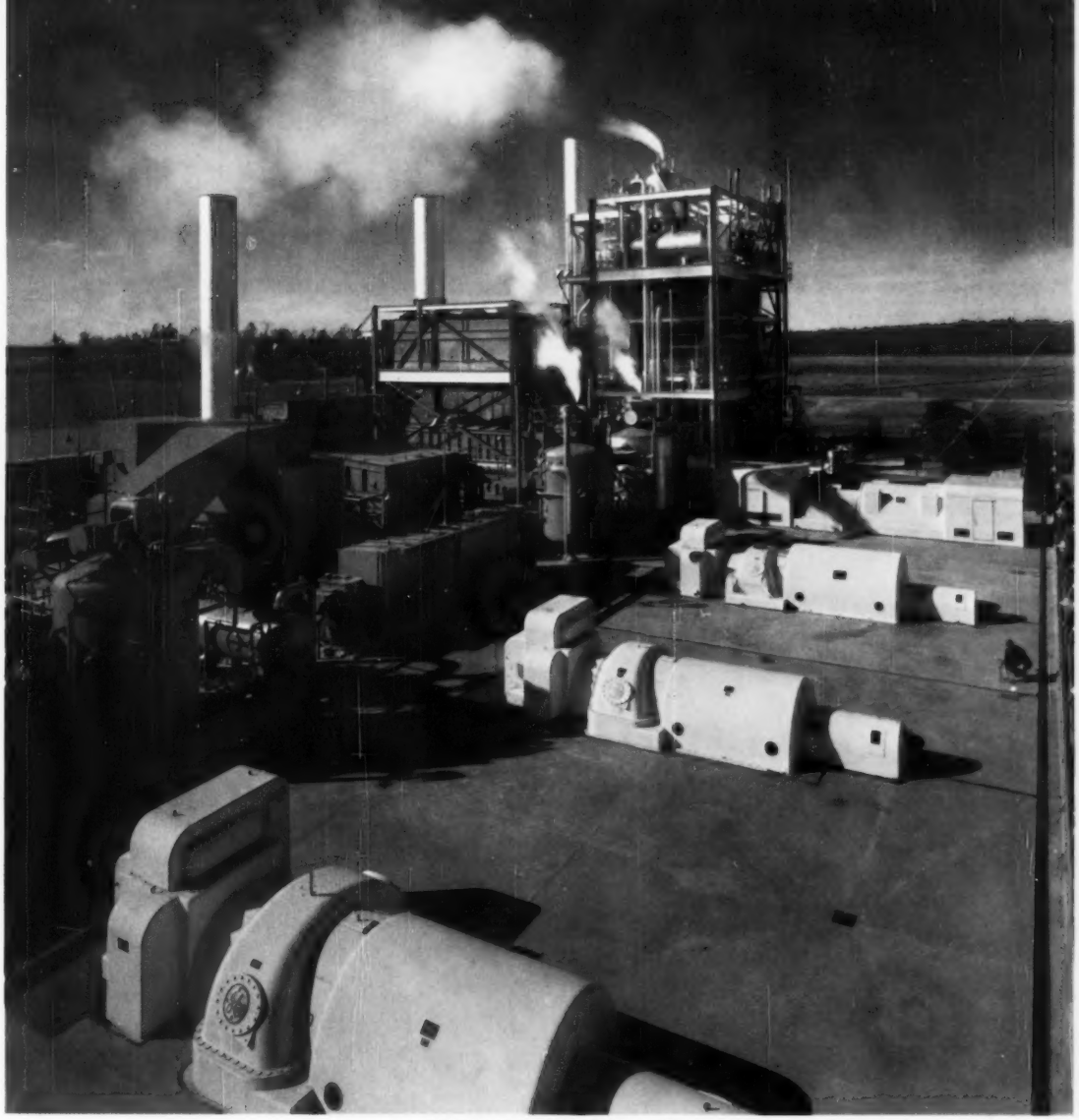
EVERY CRESCENT SCREWDRIVER IS INDIVIDUALLY TESTED

Crescent tests each and every screwdriver to make sure that blades are hardened to exact specifications . . . your assurance that Crescent tips will not break or twist.



Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK



COUGHLIN POWER STATION CENTRAL LOUISIANA ELECTRIC COMPANY, INC. 105,000 kw — 5 Units

Power in Louisiana . . .

Coughlin Power Station is an outstanding example of how major emphasis on plant expansion can anticipate economic growth. The territory served by Central Louisiana Electric Company, Inc., is in a dynamic growth period due to extensive petroleum resources, cotton, sugar, wood products and food processing activities. The company, foreseeing the operating economies of larger generating units, is expanding the capacity of Coughlin well beyond the immediate requirements of the area. Thus, in only ten years the size of units at Coughlin has steadily increased from the original 7,500 kw machines. The newest unit will be rated at 100,000 kw and will go into operation in 1961. This will give the company over 275,000 kw of system capacity with which to serve a territory with a big and bright future.

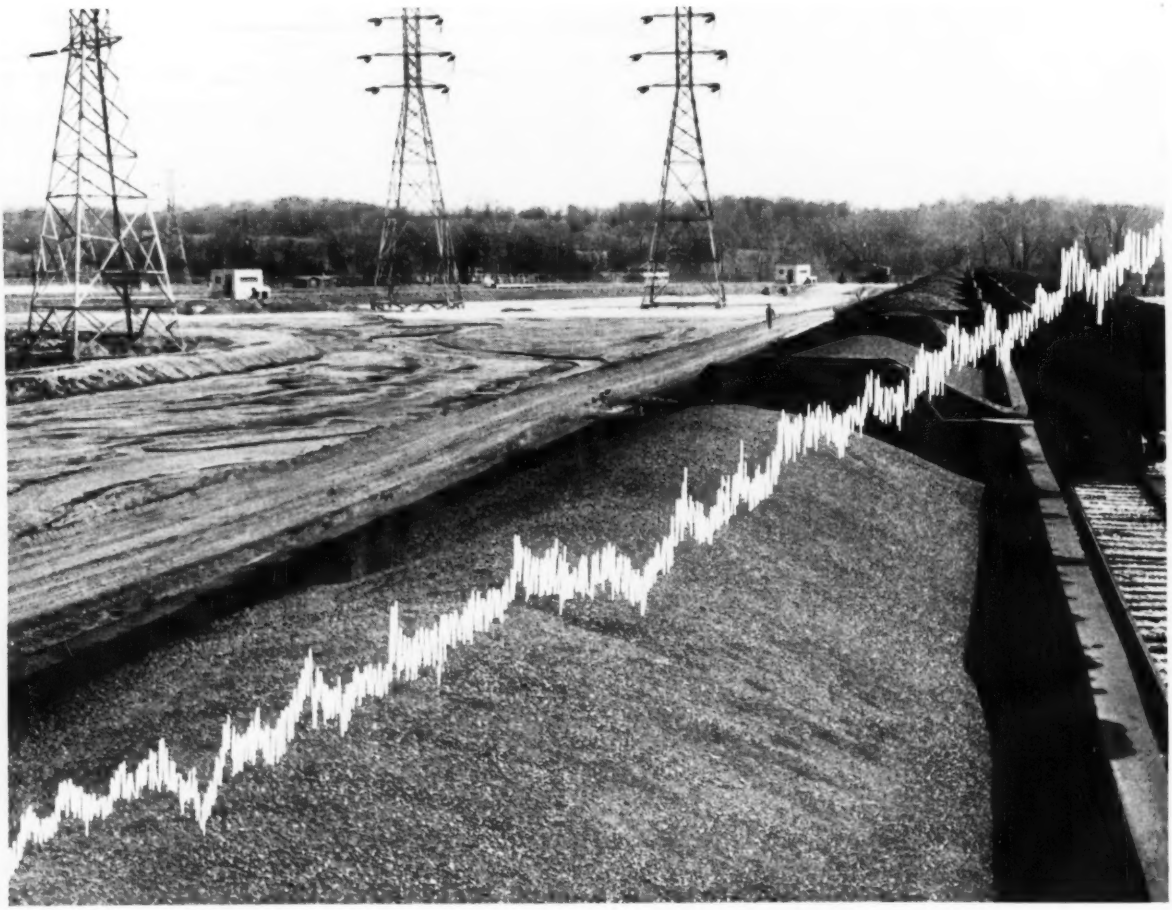
FULL COLOR BROCHURE outlining the scope of Sargent & Lundy services will be sent on request.

SARGENT & LUNDY
ENGINEERS

140 SOUTH DEARBORN STREET, CHICAGO 3, ILLINOIS

it is reassuring to utilities,

as they project the demand for power in their areas in the decades ahead . . . to know that career coal companies like Island Creek stand ready to deliver all the coal they will need. Island Creek's vast reserves,* modern mining methods and scientific preparation assure continuity of supply far into the future. Our engineers would welcome an opportunity to talk with yours.



Island Creek's vast, proven, available reserves total more today than Island Creek has taken out of the earth in the past 50 years.

You can depend on **ISLAND CREEK**

. . . a career company . . . dedicated to coal

Island Creek Coal Sales Company, Chafin Building, Huntington 18, West Va. • Cincinnati • Cleveland • Greensboro • Chicago • Detroit • New York • Pittsburgh

The Electrical Week

LATE NEWS ▶ **Boiler exploded at Commonwealth Edison's Joliet Station** on Saturday evening, Sept. 26. According to a company spokesman, explosion took place in furnace of the coal-fired B&W boiler serving No. 6 unit (325 Mw), as it was being brought up to pressure after a week-long shutdown. No estimate of damage or repair time was available.

Hurricane Gracie inflicts severe damage to pole-type transmission of South Carolina E&G for 50 miles inland along coastal area. Steel towers fared better and power plant damage is minor. System is 100% affected; full restoration may take a week around hard-hit Charleston. Half of Columbia was without service early last Wednesday. Savannah Electric escapes plant and transmission damage; distribution outages are widespread. Georgia Power's Augusta system lost parts of 13 distribution feeders for up to 24 hours.

Northern Indiana PS ranks among top ten U. S. firms in public relations this year, according to Public Relations News.

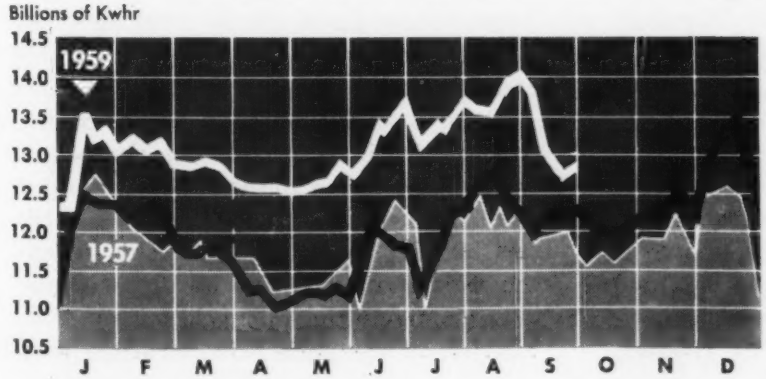
Work begins on United Engineering Center, to be erected opposite United Nations Building in New York. When completed in mid-1961, it will house representatives of 300,000 engineering firms.

Sylvania Electric unveils street-lighting program for utilities. Idea is to help make communities more conscious of the need for better lighting.

Nebraska's Gov Brooks proposes state power commission be established in order to "restore some semblance of order to the present public power arrangement in the state."

Management changes . . . John T. Plunket, vp, Cia. Impulsora de Empresas Electricas, Mexico City, becomes president of Cuban Electric succeeding, W. J. Amoss who retires.

WEEKLY POWER OUTPUT—UP 4.3% (Week ending Sept. 26), Kwhr 12,878,000,000



Per Cent Change From Previous Year

	Sept. 12	Sept. 19	Sept. 26
Total U. S.	+ 7.0	+ 4.4	+ 4.3
New Eng.	+ 1.9	+ 4.7	+ 4.5
Mid. Atlan.	+11.1	+ 2.7	+ 7.5
Cent. Ind.	+ 4.4	+ 2.3	+ 4.5
West Cent.	+ 5.9	+ 4.8	+ 5.1
Southeast	+ 6.6	+ 3.9	+ 3.9
South Cent.	+10.4	+ 5.6	+10.9
Rocky Mount.	+ 2.6	+ 6.3	+ 6.0
Pacific			
NW	+ 7.7	+11.4	+ 9.1
SW	+10.0	+ 7.6	+ 6.5

Seasonally Adjusted Index 248.8

Week Ago 245.7 Year Ago 238.4

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **A new attack on fuel transportation costs** finds Tampa Electric teamed with chemical and coal companies for transporting 800,000 tons of coal into Tampa each year and a like amount of phosphate out **(p 60)** . . . A resigned CAB member says federal regulatory agencies need revamping; FPC officials disagree **(p 62)** . . . Utility PR and advertising came in for criticism at recent PIP session **(p 65).**

ENGINEERING ▶ **Seal-type power transformers stand up well,** ten years of experience on Northern States Power Co's system proves **(p 66)** . . . Prices today make capacitors the most economical source of reactive current **(p 70).**

SPECIAL REPORT EW'S 11TH STEAM STATION SURVEY ▶ **Electrical World's 11th Steam Station Cost Survey** analyzes cost and performance data from 55 new installations. Although fuel prices have risen, design advances have helped keep down the cost of energy at the busbar. Use of higher steam pressures and temperatures; the use of reheat, and the installation of larger generating units have pushed heat rates down **(p 71).**

PROCUREMENT & PRODUCTS ▶ **Electrical manufacturers continue battle against inflation** with new price cuts . . . Long-range coal contracts bring TVA low-cost fuel . . . Okonite Co assumes responsibility for Kennecott Wire & Cable

Politics and Public Power

2% MONEY—A POLITICAL LIABILITY

The increasingly healthy state of rural electric cooperatives's finances (EW, Sept. 28, 1959, p43) has a lot of people—both in Washington and down on the farm—wondering just how long 2% money for rural electrification loans will remain politically sacred.

Even among rural people and long-time cooperative supporters they're asking the question of whether the economic advantage of cheap money is now more than offset by the political furor it's causing.

Recently, no less a national figure than Herschel D. Newsom, Master of the National Grange and a founder of the co-op that serves his farm in Indiana, questioned before a private utility audience the propriety of 2% money for generating facilities. He specifically refused to come out for the now pending $53-million C&T loan for Hoosier Electric Generating Corp, although he did not oppose it, either. He seemed to be waiting to see which way the political wind will blow. And it should be remembered that Newsom is the Washington representative of a large national organization. He is not likely to identify himself or the Grange with any cause that could, in any sense, be labelled "irresponsible."

Then there's the new line that REA Administrator David Hamil is taking at all 10 regional meetings of the National Rural Electric Cooperative Assn this fall.

Hamil is telling the co-op groups on the regional circuit to "behave like the success you are," and he has all the evidence to prove that most of the co-ops are successes indeed. Says Hamil: "Some of you howl as though you were stranded on an alkali flat when, in fact, you're sitting on a gold mine."

A few of the statistically verifiable facts

Co's sales effective on Nov. 1 of this year (p 92).

MANUFACTURERS ▶ **Westinghouse maps low-cost A-power program** . . . Leeds & Northrup sells LN 3000 computer to Public Service E&G (p 94) . . . Portland General Electric uses tubular aluminum crossarms by Aluminum Co of America on 230-kv, H-frame line . . . Mitsubishi Electric readies huge 312-Mva transformer for Minami Kawagoe substation near Tokyo (p 96).

NEW EQUIPMENT ▶ **Circuit breakers for low-voltage installations** can be operated manually or electrically using the stored energy principle . . . Work aisles for switchgear protects workers from weather (p 98).

MANAGEMENT ▶ **Economic depreciation turned up in new form** at American Bar Assn's recent Miami meeting, and inspired mixed utility reaction. Chief objection to the proposal is that it is confined to taxes, and ignores regulatory and accounting aspects. "Without rate recognition, this could do more harm than good," said an ED advocate (p 125).

SELLING ▶ **Homes of all sizes are going electric with heating.** A southern mansion and a rustic cabin recently became converts (p 112).

which back Hamil's "gold mine" contention:

• REA borrowers in '58 set aside 13.3% of their operating revenues as surplus, compared to 13.1% in 1957.

• Earned surplus passed $450 million in '58, an increase of more than 18.7% over '57.

It's too early to say yet just what will happen to the 2% interest rate. Certainly, the present Congress is not likely to change it. But there does seem to be stirring the beginnings of a grass-roots consciousness that below-cost government loans, in the face of the co-ops' continuing prosperity, can result in an untenable political position. It bears watching, anyway.

THE LURE OF PORK

The fight over new federal water and power projects is only suspended, not over with by any means. The budget of the President, now in preparation, will renew the battle when it goes to the Democratic Congress next January.

The Administration will try for two policies (1) Keeping at a minimum second-year money for the 67 starts it finally was forced to accept this year, (2) A no-new-start policy.

Eisenhower and Budget Director Maurice Stans are adamant. They see a precariously balanced budget going to Congress in January—one which can go into the red should spending balloon or should any kind of business lag reduce revenues.

It was bad enough, they said, to finally accede to Congressional pressure and apportion the $52,644,000 for beginning the 67 new projects. The total cost is estimated at $804 million, but the White House will demand that the money be spread thinly, at least until Eisenhower leaves office on Jan. 20, 1961.

Executive Reader

Taxes on utility poles set within highway limits should be not less than the cost to the highway agency nor more than the benefit to the utility. Such benefit can be measured by the added cost of using a non-highway location, typically higher for private utilities which must pay for easements. Forcing Oregon utilities off rural Federal-aid roads could boost their service costs $200,000 to $250,000 annually, concluded **H. T. Koplin** and **D. A. Watson** in a 54-page report published by **University of Oregon's Bureau of Business Research.** Copies cost $1.00.

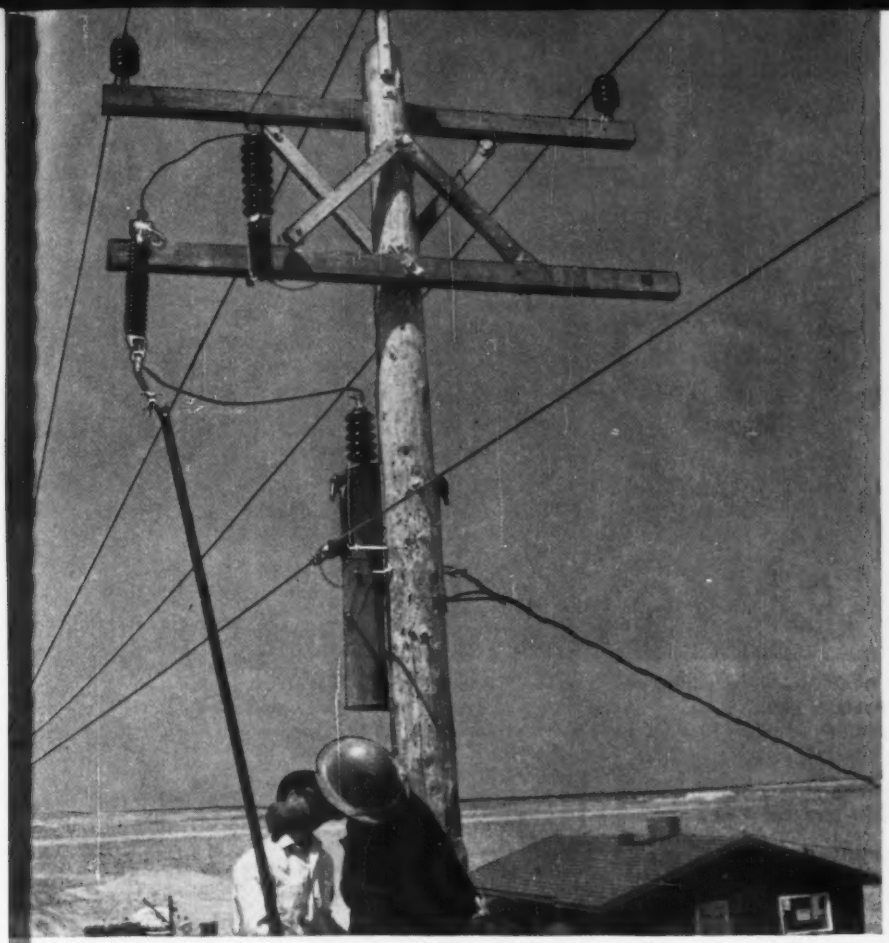
Fourteen stockholder committees of the Wisconsin Power & Light Co keep the company in close touch with approximately 28,000 Wisconsin stockholders. This practice has been going on for the past 25 years. Committees ranging in size from six to 20 members were organized in each operating district to represent the interests of all stockholders of the area. It serves as a liaison between the company management and the stockholders. **Carl Forsberg, EEI Bulletin, September 1959.**

All utility records may someday be stored in a computer's memory unit. Random access would let certain personnel "read" the memory while others feed in new data. Such a computer could even include quick switching from one program to another, thereby enhancing its value to a small utility and spreading its cost over several functions. **Dr. Howard Aiken, Harvard University Computation Laboratory, EEI Bulletin, September 1959.**

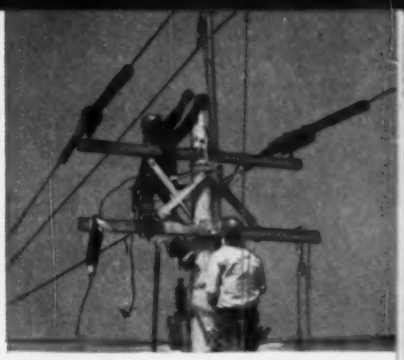
Soviet nuclear power plant presently under construction near Woronesch on the Don River, claimed to be the World's biggest will start producing power very soon according to the East-Zone publication "Neues Deutschland." Initial capacity of the pressurized-water moderated plant is 420 Mw. The 44 tons of enriched uranium elements in the reactor are enough for 18 months uninterrupted operation.

A second Soviet atomic power plant is under construction in Belojarsk (Urals). The plant will be in two "blocks" of 100 Mw each. The reactor is a uranium graphite unit very similar to the first Soviet atomic plant, but improved technically and economically. Yield coefficient is 33.8% and fuel charge 90 metric tons of uranium . . . enough for two years continuous operation.

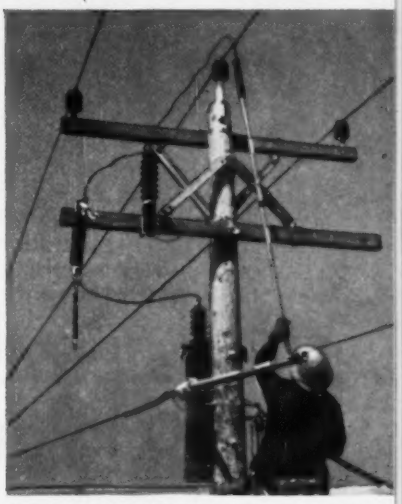
British firms are finding it impossible to sell atomic reactors in Europe. A recent government committee report, published by Euratom, blames unfair commercial competition. It says terms offered British buyers compared unfavorably with special terms offered by American that include "guarantees backed by U. S. government." British firms, it said, must recover costs from sales, including royalties.



L-M 27 KV TYPE HDO fuse cutout and Type SS arrester protect this 20 kv Round-Wound transformer.



IT IS PRACTICAL to work 20/34.5 kv distribution lines hot, when proper safety procedures such as these are followed.



WITH JOB COMPLETED, hot line clamps are tightened in place prior to removal of protective line hose.

Idaho Power Company Uses L-M Equipment for 20/34.5 kv to 240/120 Volt Service Drop

Idaho Power Company has overcome the problems posed by great distances and low population density, through installation of a three-phase, four wire, 34,500 volt grounded wye distribution line. This system eliminates the need of all subtransmission and has fewer substations, less regulating equipment and higher feeder loading, resulting in lower cost per kva of installed capacity. It has proved most economical in distributing power along the 275 miles of isolated farm land.

L-M has cooperated with progressive Idaho Power through research and development of apparatus and construction materials to make this economical distribution voltage practical. All products for the 150 kv BIL system are available from L-M—switching equipment, porcelain insulators, capacitors, cutouts, lightning arresters, reclosers and Round-Wound® transformers.

Get Complete Information.

L-M offers a compilation of data on the design and operation of 20/34.5 distribution. Ask your L-M field engineer for these papers, or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

McGRAW EDISON

Distribution Specialists

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DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

CLUSTER-TYPE POLE-MOUNTED RACK, pre-wired, with switches, ready to install. Available in 600, 900, and 1200 kvar. Three frames are bolted to the pole mounting bracket and to each other. These racks may be hoisted in three sections, or may be bolted together on the ground and hoisted as a complete unit.

Here's L-M's Outstanding New Line of 100 kvar Capacitors, Equipments

L-M announces a revolutionary new 100 kvar stainless-steel Elemex capacitor which is smaller, lighter, more compact because of transformer-type cooling; a complete new line of corrosion-proof aluminum-alloy hangers, racks, blocks.

by **N. K. DELANEY**, Product Manager
Capacitors and Regulators
Line Material Industries

All 100 kvar capacitors announced to date present the utility man with a problem of excessive size and weight. To overcome this problem, Line Material research engineers have developed a revolutionary new capacitor design.

Cool . . . Cool . . . Cool!

In this new L-M 100 kvar capacitor, transformer-type liquid circulation makes possible a very substantial weight and size reduction, and keeps hot-spot temperatures even lower than in L-M's (or others') 50 kvars! The design provides cooling ducts in sides and ends of the tank. Elemex Liquid circulates freely up between the packs and down the sides, keeping temperatures low. Tanks are stainless steel with heat-radiating paint finish.

NEMA-Standard 15⅝" Mounting

The new Elemex is the only 100 kvar that meets NEMA-standard mounting dimension of 15⅝ inches—the same as 50 kvar and smaller units! This makes it possible to replace two 50's with one 100 kvar—*in the present rack.*

Full Line of Hangers, Racks, Blocks

A complete line of hangers, racks, and blocks has been specially designed for these 100 kvar units. All are light, strong, corrosion-proof aluminum alloy.

The line includes the following:

- single-unit hangers (100 kvar).
- 3-unit hangers (300 kvar).
- single-row pole-mounted racks for 300, 600, and 900 kvar.
- cluster-type racks for 600, 900, and 1200 kvar.
- block frames with ratings from 600 to 2000 kvar in 200 kvar increments.
- elevating structures

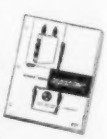
JUST LOOK AT THESE FIGURES!

Brand	Over-all Height	Tank Width	Tank Thickness	Mounting Dimension	Weight 2400 V 100 kvar
L-M	32 7/16"	13½"	9⅛"	15⅝"	185 lbs.*
Co. B	33⅛"	20"	7½"	22⅝"	270 lbs.
Co. C	33½"	25"	5½"	27⅛"	260 lbs.

**15% less per kvar than L-M's own 50 kvar.*

NEED WE SAY MORE?

Why Wait? Act Now! Discuss this new L-M 100 kvar Elemex Capacitor with your associates. Get in touch with the L-M Field Engineer right away—or wire or phone Line Material Industries, Milwaukee 1, Wisconsin, to reserve the supply you will need.



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LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

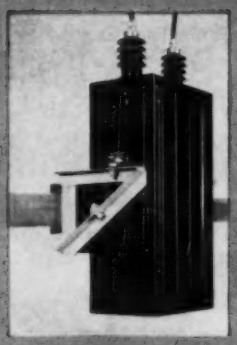
DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

The first capacitor with real liquid circulation.

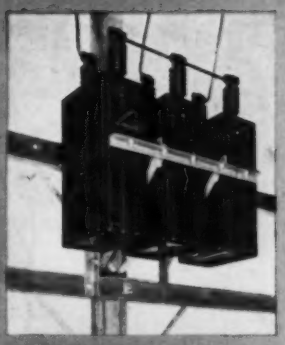
The cooling ducts do it.

Elemex liquid does it.

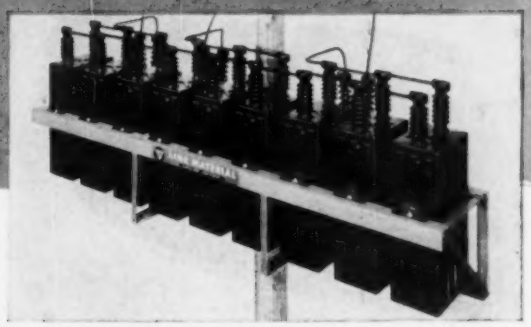
L-M Research did it... *again!*



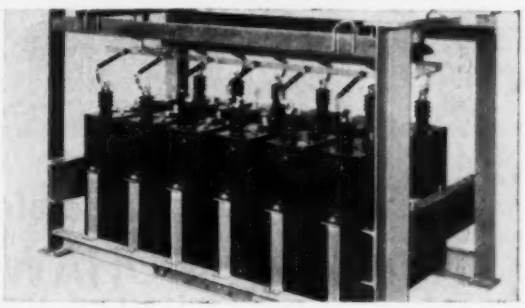
SINGLE-UNIT CROSSARM HANGER.



THREE-UNIT HANGER. All have ground clamp for either aluminum or copper conductor.



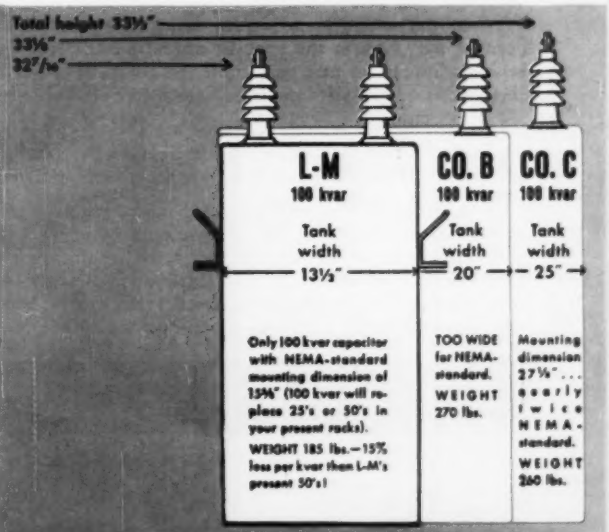
SINGLE-ROW pole-mounted racks are available for 3, 6, and 9 units—300, 600, and 900 kvar. All these racks are of welded construction. Galvanized steel pole bands (instead of using through-bolts) are an optional accessory.



BLOCK FRAMES are of all-welded construction, jig-assembled for accurate alignment. Ratings are 600 to 2000 kvar in 200 kvar increments. Fuses have 4000-amp. interrupting capacity each. Space saving averages about 25%, in comparison with blocks of 50 kvar units.

THE HOT-SPOT TEMPERATURE of L-M's new 100 kvar is even lower than that of 50 kvars, because of this new transformer-type liquid cooling. The Elemex Liquid rises between and around the packs, then goes down through the ducts and is cooled. The packs are cooler, because the heat comes out!

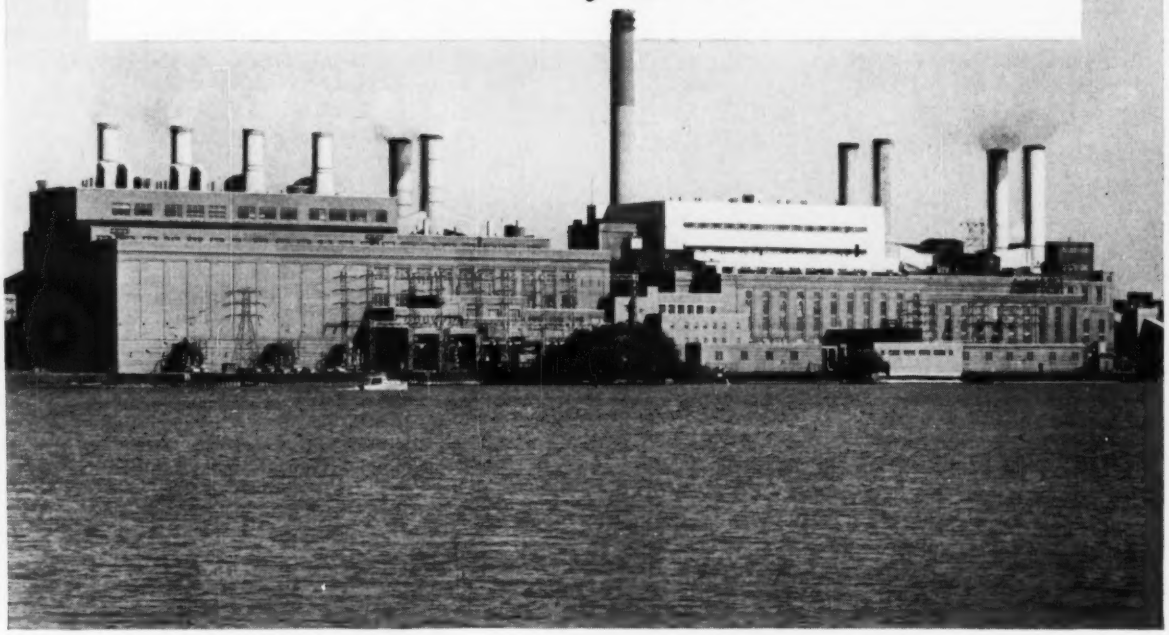
DIAGRAM shows how compact the new L-M Elemex capacitor is. Note also the weights. The lighter weight and narrower tank reduce bending moment on the pole, make capacitors and racks easier for linemen to handle and hoist.


Total height 33½"
33¼"
32⁷/₁₆"
L-M
100 kvar
Tank width 13½"
Only 100 kvar capacitor with NEMA-standard mounting dimension of 13½" (100 kvar will replace 25's or 50's in your present racks).
WEIGHT 185 lbs.—15% less per kvar than L-M's present 50's!
CO. B
100 kvar
Tank width 20"
TOO WIDE for NEMA-standard.
WEIGHT 270 lbs.
CO. C
100 kvar
Tank width 25"
Mounting dimension 27½"... nearly twice NEMA-standard.
WEIGHT 260 lbs.

Elemex Capacitors

McGRAW EDISON

Another REVERE Condenser Tube and Plate Installation



Another Dependable Worthington Condenser for

NIAGARA MOHAWK POWER CORPORATION

(Unit #67 Huntley Steam Station, Buffalo, N. Y.)

The 95,000 sq. ft. Worthington Surface Condenser is equipped with 196,000 pounds of Revere Admiralty Condenser Tubes, and 29,000 pounds of 1½" thick Revere Muntz Metal tube sheets.

These particular metals were selected by the manufacturer because they best fit the specific operating conditions that will be encountered in this particular installation. Other operating conditions and requirements call for other alloys.

It is this careful selection of the "metal to fit the job" that has built, for Revere, a reputation for dependable condenser tube and plate performance under all kinds of operating conditions.

Over the years Revere's Research Department has compiled extensive data regarding the relative corrosion resistance of the different alloys under a wide variety of operating conditions. Why not take advantage of this storehouse of facts and consult with Revere's Technical Advisory Service before selecting the tubes and plates for your equipment?

COPPER • BRASS 18 01 REVERE ALUMINUM

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

Mills: Rome, N.Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere.

INTEGRAL FINNED TUBE • BIMETAL TUBE • INSTRUMENTATION TUBE • CONDENSER TUBES IN CUPRO-NICKEL, ALUMINUM BRASS, ADMIRALTY, HERCULOY, ARSENICAL COPPER, MUNTZ METAL AND OTHER ALLOYS. ALUMINUM TUBE, SHEET AND EXTRUSIONS. SMALL AND LARGE PLATES IN CUPRO-NICKEL, COPPER, HERCULOY, MUNTZ METAL, NAVAL BRASS AND ADMIRALTY.

Only 3 Stator Meters Assure Accurate Measurement of 4-Wire Wye Services

FRED KURZ
Director: Watthour Meter Engineering,
Sangamo Electric Co.

A three stator meter measuring energy in a four-wire wye service makes no assumptions in providing complete metering accuracy.

In the 19th century, Prof. Andre Blondel stated that a watthour meter with n-1 stators is required for accurate measurement of electric energy in a single phase or polyphase system with "n" wires. Through the years this theory has been applied in millions of metering installations.

Meters having fewer stators than prescribed by Blondel's theorem have been designed primarily for reasons of economy. These meters accurately measure loads only under so-called "normal conditions." When "normal conditions" do not exist, measuring errors occur, depending largely on the magnitude of the voltage unbalance and the kind of load that is measured.

A survey of three-phase secondary service voltage unbalance, taken from the minutes of the 60th meeting of the Transmission & Distribution Committee of EEI, Feb., 1953, indicates that 85% of wye or closed delta transformers operate with voltage unbalances ranging up to 5.94%. Unbalanced current, voltage and power factor conditions in 1953 have since been magnified by the application of more and more large single phase motors for air conditioning. Furthermore, energy consumption has almost doubled since that time.

Polyphase meters make up only 8% of the meters in service, but they measure approximately 60% of the energy consumed. A large share of this revenue comes from 4-wire wye services, and even slight registration errors can result in large revenue variations.

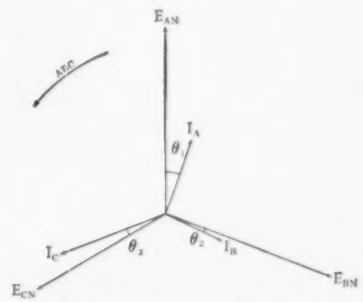
Due to the possibility of registration errors from unbalanced conditions, it does not seem feasible that today's high metering accuracy standards should be sacrificed — especially when a high capacity, low cost, three stator meter which makes no assumptions is now available.

These meters are of single disk construction and are as small in size and weight as two stator meters. Each stator has only one current coil, therefore there is no coil balance problem, and adjustments are provided to equalize the torques of the three stators as closely as may be desired. In general, the losses in the three current circuits are approximately equal and can be made low enough to provide high current carrying capacity; this is particularly important in Class 200 meters.

Errors at extreme load unbalance, approaching the class level, are reduced in three stator meters by designing the meter with a slow disk speed at rated load. In the case of the single disk three stator meter, the weight of the moving system is substantially the same or even lower than that of the usual two stator meters. This factor, together with slow speed at rated load, provides stability of accuracy.

Single disk construction enables the meter tester to calibrate the three stator meter with standard test procedures (no 4/3 test factor). This, combined with fewer adjustments, reduces calibration time in relation to other 4-wire wye meters.

The inherent advantages and resulting benefits of 3 stator metering should be evaluated in terms of: 1) total installation cost versus revenue, 2) confidence in the accuracy of the measuring instrument, 3) ease of calibration and testing, 4) versatility of application which reduces stocking problems, 5) elimination of installation mistakes and possible loss of revenue, and 6) the important knowledge that customer goodwill is assured.



$$P = E_{AN} I_A \cos \theta_1 + E_{BN} I_B \cos \theta_2 + E_{CN} I_C \cos \theta_3$$

Meter Registration = 100% under all conditions of load

FROM SANGAMO:

Another new product developed to meet your needs

P-3 METER ASSURES FULL

Full 200 Ampere Capacity in a Single Disk Three Stator Meter

The increased capacity and reduced price of the P-3 meter make its cost/KVA only $1.21 compared to $2.06 for bathtub-type three stator meters—a difference of 85 cents/KVA of meter capacity.

The benefits of three stator accuracy should be re-evaluated now that the P-3 meter offers lower cost/KVA. The difference in installed cost of P-3 and 2½-stator meters is insignificant for self-contained installations to 200 amperes and for current transformer installations. The small difference in installation cost should be compared to the possible loss of revenue from meters that do not offer three stator accuracy.

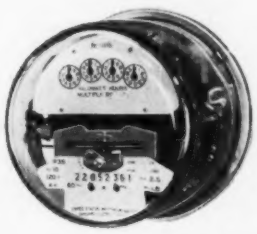
Greater sustained accuracy—Near perfect load response to 200 amperes. Slow disk speed (8⅓ revolutions per minute) and very high torque on single disk permits reduced series damping—minimizes speed variations and compensations.

Easier to handle—The single disk round design cuts weight by 50%—volume by 50%—as compared to bathtub-type three stator meters.

THE ONLY COMPLETE LINE

Class 10—bottom-connected and socket meters for transformer-rated installations.

Class 100 and 200—socket construction for growing loads.



SANGAMO

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JH 59-5

REVENUE FROM LARGE LOADS

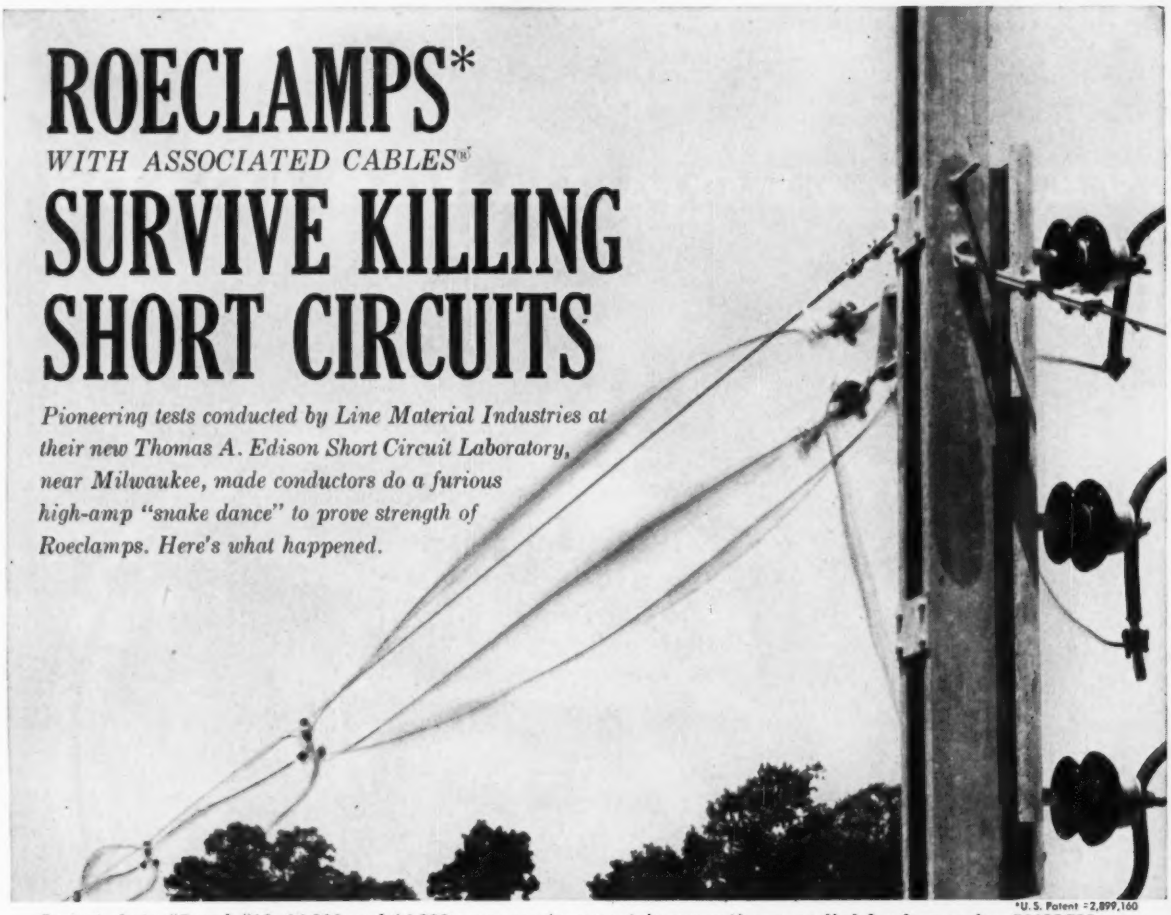
NOW... A 5% PRICE REDUCTION gives you *three stator accuracy* for an *installed cost* only slightly more than compromise metering.

ROECLAMPS*

WITH ASSOCIATED CABLES

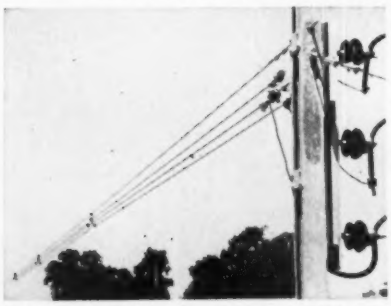
SURVIVE KILLING SHORT CIRCUITS

Pioneering tests conducted by Line Material Industries at their new Thomas A. Edison Short Circuit Laboratory, near Milwaukee, made conductors do a furious high-amp "snake dance" to prove strength of Roeclamps. Here's what happened.

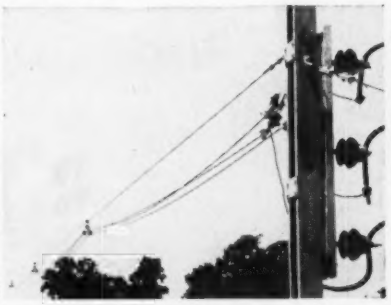


*U. S. Patent #2,899,160

In test shots #7 and #12, 14,300 and 14,200 amperes (asymmetric current) are applied for four cycles. 500MCM conductors are whipped around with incredible force. Strong 5KV and 15KV Roeclamps contain the cables, and withstand this fantastic overload. These were two of over a dozen test shots conducted in the impartial Line Material laboratory.



Roeclamps and various sized associated cables were installed in 128 feet span, shorted at far end and linked with power source and controls inside Line Material Industries' new laboratory. Every 30 feet a Roeclamp holds cables and messenger firmly in place. Roeclamps require no installation tools, can be mounted in less than a minute, even with "boxing gloves" on.



In test shot #2, 3950 amperes (asymmetric current) was applied for 30 cycles to a #6 AWG conductor. This was approximately 100% beyond the rated thermal capacity of the insulation. Note that the 5KV Roeclamps are undamaged. In this test the intense heat (conductor temperature 395°C) elongated the cables but they soon resumed their former profile.

Line Material Industries' short circuit Lab features a closed circuit TV Monitor panel to observe testing. It has the most modern metering equipment, and the world's highest speed, 60-cycle generator for short circuit testing. This can deliver over 500,000 KVA of electrical energy momentarily. A 1,500,000 KVA air blast breaker can interrupt 80,000 amperes after any pre-set current flow.

NOW ON FILM

SEE THESE STARTLING TESTS OF ROECLAMPS WITH ASSOCIATED CABLES FOR YOURSELF

A 16mm color movie, showing the complete series of tests is now ready for showing to technical groups. For details write to Line Material Industries, McGraw-Edison Company, 700 W. Michigan Street, Milwaukee 3, Wis., or to Roebling's Electrical Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
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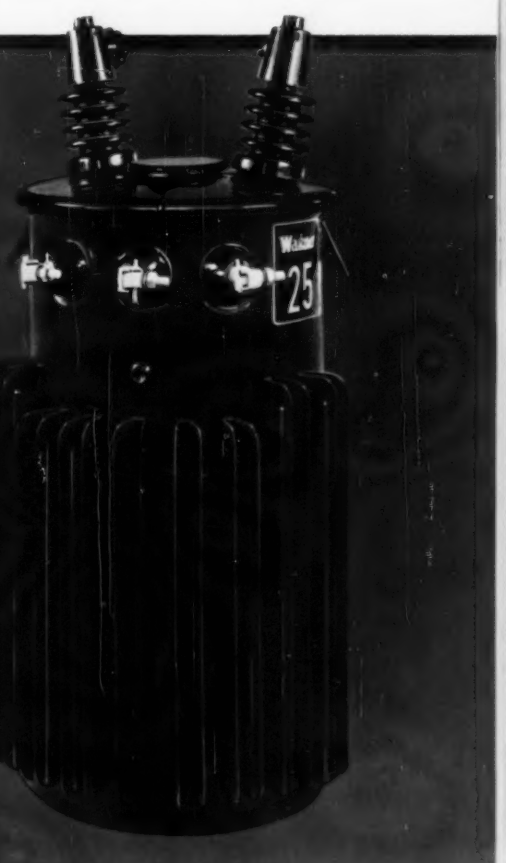
The Colorado Fuel and Iron Corporation

Wagner
25

The distinctive blue and gold Wagner identification on pole-type transformers is a sign that here is a transformer you can rely on for utmost dependability. Constant research and development have kept Wagner up front in transformer design for more than 65 years—made the name Wagner one of the foremost in power planning.

LONGER LIFE...GREATER EFFICIENCY...
DESIGNED FOR MODERN-DAY LOADS
Wagner FORM W Transformers

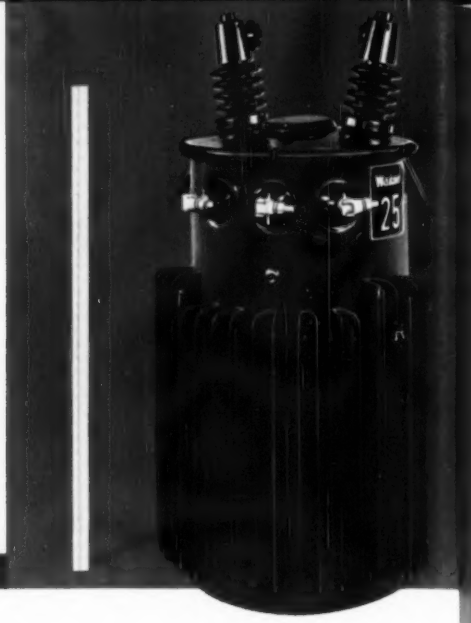


Wagner Form W single phase pole-type distribution transformers have been designed for lower impedance values, better regulation and lower losses. They have mechanical features that give you easier installation, safer operation, and longer service life.

GUARANTEED LOSSES REDUCED... Wagner's published electrical performance sheets for a 25 kva, 7200 volt transformer show that guaranteed core losses have been cut approximately 12 per cent . . . total losses cut approximately 5 per cent. Other kva and voltage ratings have correspondingly improved loss ratios.

The complete line of pole-type transformers, from 3 to 167 kva, is available from stock to meet your distribution system requirements.

Here are the *Extra Values* that you get with Wagner Form W Transformers

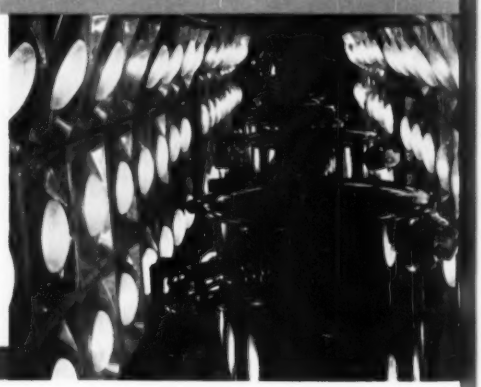


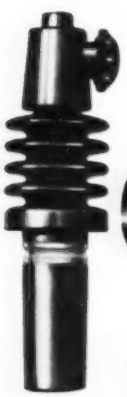
SMALLER SIZE THAN EVER BEFORE

Wagner's line of single phase pole-type distribution transformers has been redesigned to give you extra value from your transformer investment. One result of this redesign is a substantial reduction in size. The 25 kva Type HEK Transformer, for example, is now only 41⅝ inches high — including the cover mounted bushings!

LOWER EXCITING CURRENT . . . the improved quality annealed steel core used in these transformers provides a low reluctance path for the magnetic lines of force resulting in a much lower exciting current. Lower impedance, better ratio of losses, and improved regulation have also been achieved.

LONGER LASTING TANK FINISH . . . A new formula anti-corrosive paint is hot spray applied on tank sizes below 50 kva—flow coated on larger sizes. A primer coat, intermediate coat and finish coat are each cured by running the tanks through a tunnel of infra-red lamps or through controlled heat chambers. The result is a "Sure Seal" finish that withstands all temperature changes — is much longer lasting in corrosive atmospheres.





SAFETY-KEYED BUSHINGS

Heavy wet process porcelain high voltage bushings are safety-keyed. All terminals are key-locked in the bushing porcelain — sidewall bushings are key-locked in the tank wall. Hand tightening terminals are easily hooked up without tools. Cover bushings have insulated terminal guards to prevent outages caused by birds or animals. All bushings are suitable for use with either aluminum or copper conductor.

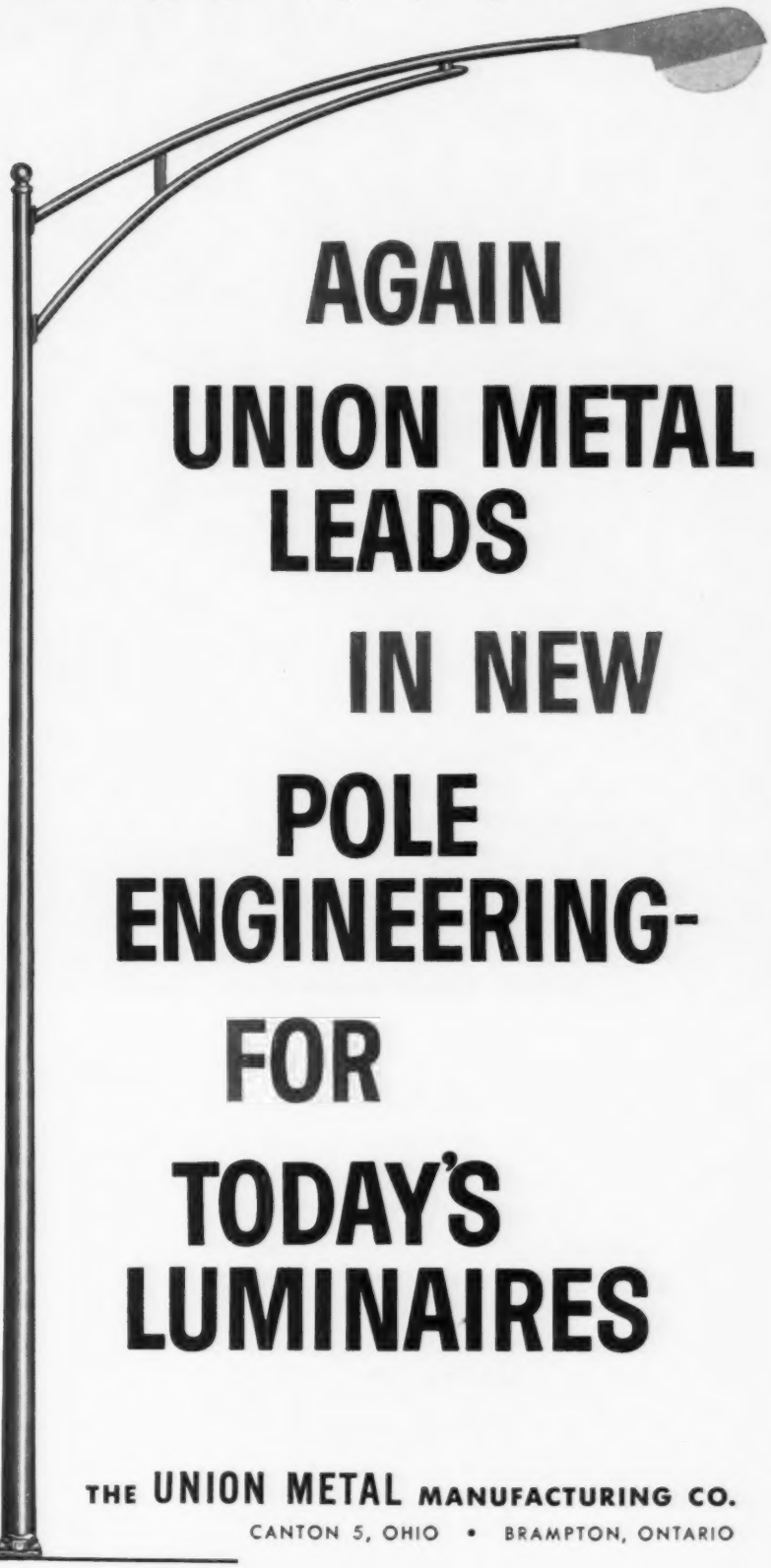
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6400 Plymouth Ave., St. Louis 14, Missouri.

WT59-8

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL* . . . *AUTOMOTIVE*



AGAIN UNION METAL LEADS IN NEW POLE ENGINEERING- FOR TODAY'S LUMINAIRES

Announcing

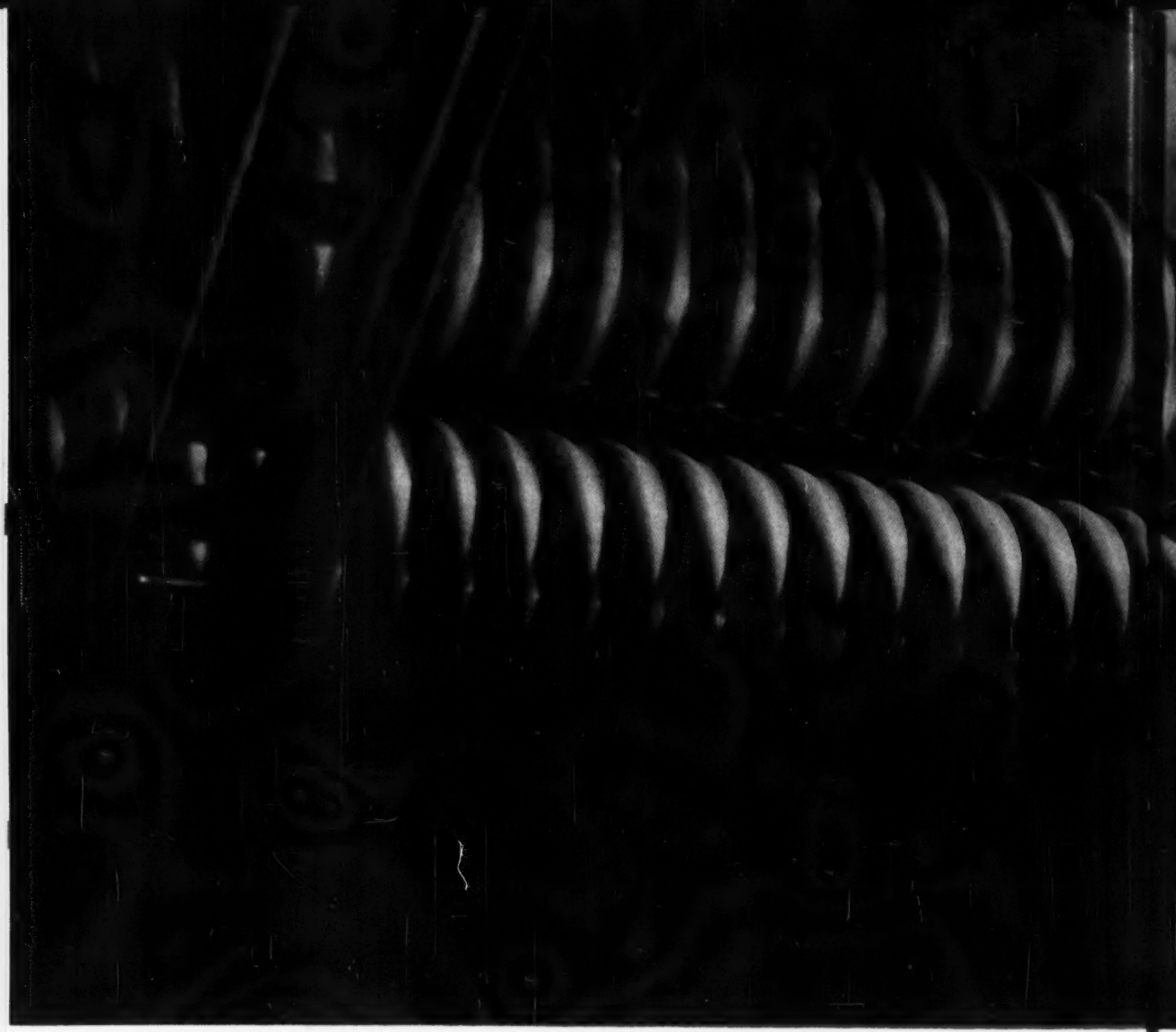
BULLETINS LS-29 AND LS-30 featuring steel and aluminum poles properly engineered to meet today's rigid roadway requirements.

Monotube poles have the required "built-in" qualities for supporting the latest in filament, mercury and fluorescent luminaires.

Monotube Engineered Poles

THE UNION METAL MANUFACTURING CO.

CANTON 5, OHIO • BRAMPTON, ONTARIO



Installs like cable . . . protects like conduit!

Conduit-like protection . . . yet it's *flexible!*

And because it's flexible, you can install Rome's interlocked armored cable as easily as most ordinary cables—around corners, machinery, other obstructions. You merely pull it through in long, unbroken runs on low-cost cable-supporting ladders,* or suspend it aerially with cable rings. Where you need to splice, a mechanical joint does the job in a jiffy.

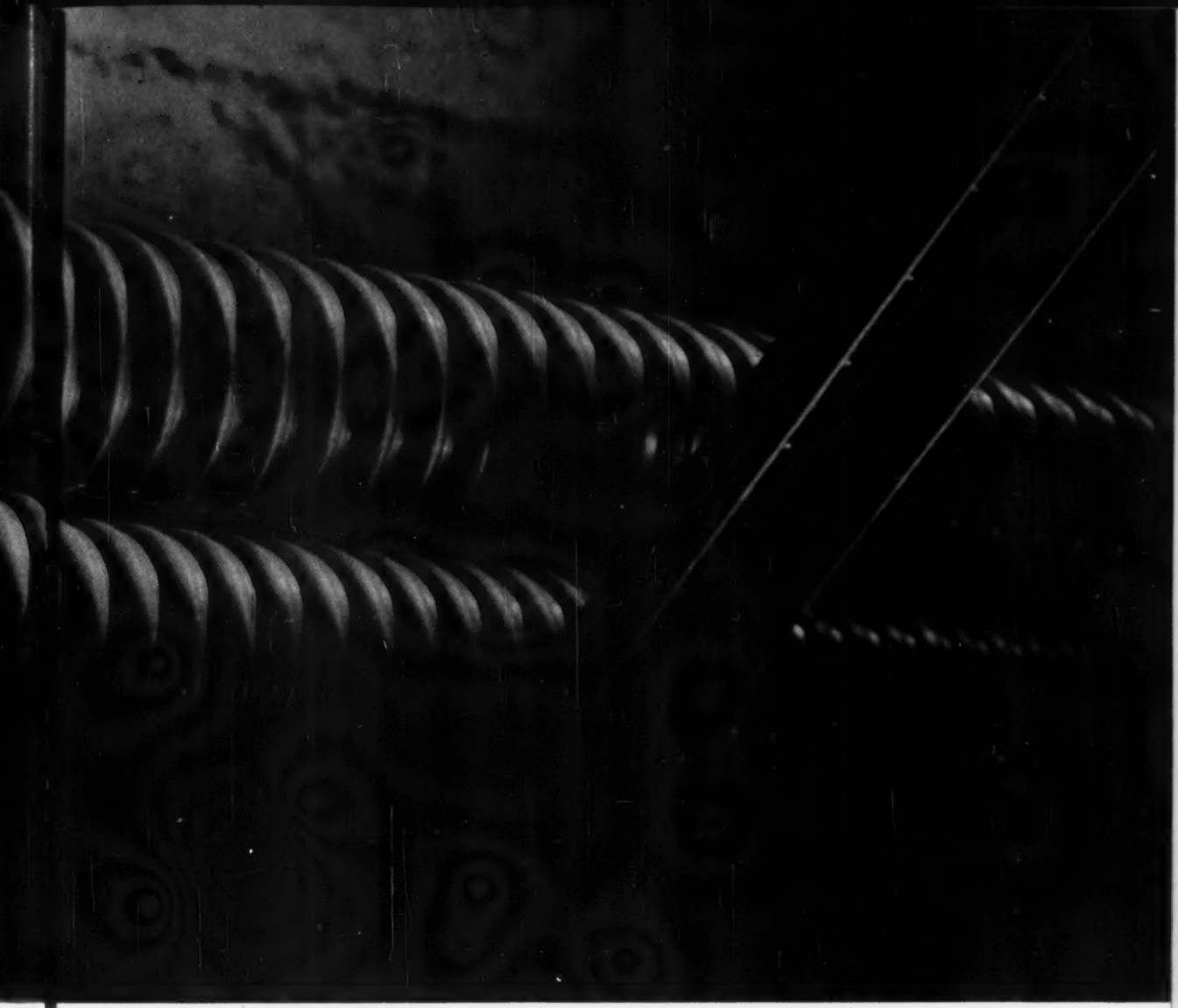
Rugged protection And it's *rugged.* A metallic armor of aluminum alloy, bronze or galvanized steel provides high mechanical protection for your electrical system. If you need exceptional corrosion resistance, you can get it with a thermoplastic (PVC) sheath over the armor.

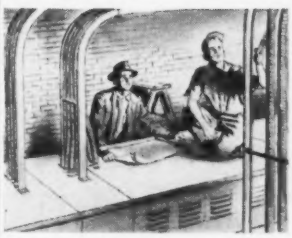
Increased ampacity Because it approaches a free-air type of installation, Rome's interlocked armored cable has a high current-carrying capacity. Heat is dissipated readily—not trapped as it would be in conduit.

Saves space And you save space—almost one inch less space for each 3/C 500 MCM of interlocked cable than for conduit-type installation. Just one cable ladder* supports a substantial number of interlocked armored cables, takes far less space than multiple-conduit runs.

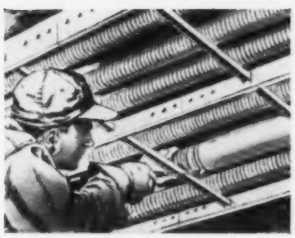
For heavy-duty service You can use Rome's interlocked armored cable for almost any heavy-duty service application: in power plants, food processing plants, refineries, steel mills, pulp and paper mills, chemical plants. It is widely used for high-voltage primary feeders from power stations to unit substations and for secondary feeders from unit substations to load centers.

Available in three-conductor construction, rated at 600, 5000 to 15,000 volts. You can get all the details in Bulletin RCP 730. Clip and mail the coupon for your copy.





Easy to service You can make inspections easily—cables are fully accessible on open cable-supporting ladders,* or suspended on cable rings. In case of accidental damage, you merely cut out a short section and splice. No need to pull out the cable as you do with conduit.



Easy to add new circuits In the event of changes in plant layout, the simplicity of these systems makes it easy to add new circuits to existing runs. Systems can also be easily and quickly dismantled and reinstalled elsewhere—with a minimum of scrap.

Cable-supporting ladders (either galvanized or aluminum) are manufactured by T. J. Cope Division, Rome Cable Corporation, Collegeville, Pennsylvania.

Insulation The butyl compound insulation (Rozone A) used on Rome's interlocked armored cable is heat-, moisture- and ozone-resistant. Cable can be installed out of doors or in other damp locations safely. Metallic armor provides exceptional mechanical protection.

ROME CABLE
DIVISION OF **ALCOA**
Department 15-10, Rome, New York

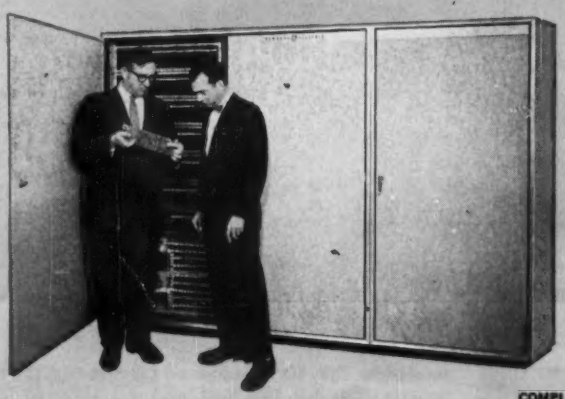
☐ Please send me more information on the above.

Name .....
Title .....
Company .....
Street .....
City ..... Zone ..... State .....

MEET THE MAN
WHO'S DEDICATED TO YOUR JOB
YOUR ROME CABLE SALESMAN

COMPUTER PROGRESS FROM GENERAL ELECTRIC

AUTOMATION OF STEAM ELECTRIC STATIONS CAN BE ACHIEVED WITH THE NEW GENERAL ELECTRIC GE 312 DIGITAL CONTROL COMPUTER!



GENERAL ELECTRIC **PROCESS CONTROL** AUTOMATED BY GENERAL ELECTRIC

COMPLETELY TRANSISTORIZED GE 312 DIGITAL CONTROL COMPUTER

Steam electric station automation, built around the GE 312 Digital Control Computer, can result in reduced maintenance costs, reduced forced outage rates, improved fuel economy.

The GE 312 Computer provides:

COMPUTER-CONTROL of the boiler-turbine-generator unit for fully automatic start-up (hot and cold), normal operation, normal or emergency shut-down.

RAPID, AUTOMATIC LOGGING of analog and digital readings from hundreds of data points.

MONITORING AND ALARM SYSTEM which detects and corrects undesirable conditions.

CONTINUOUS AND FULLY AUTOMATIC PERFORMANCE CALCULATIONS, on an up-to-the-minute basis, to achieve more efficient plant operating conditions.

Request brochure CPB-36A. For information on computers, data processing and automatic control, contact your GE Apparatus Sales Division Office, or write: Computer Department, General Electric Co. Deer Valley Park • Phoenix, Ariz. • Rm. 6600 AB

Progress Is Our Most Important Product

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FOR FIGURES IN A HURRY—FIGURE ON A GE COMPUTER

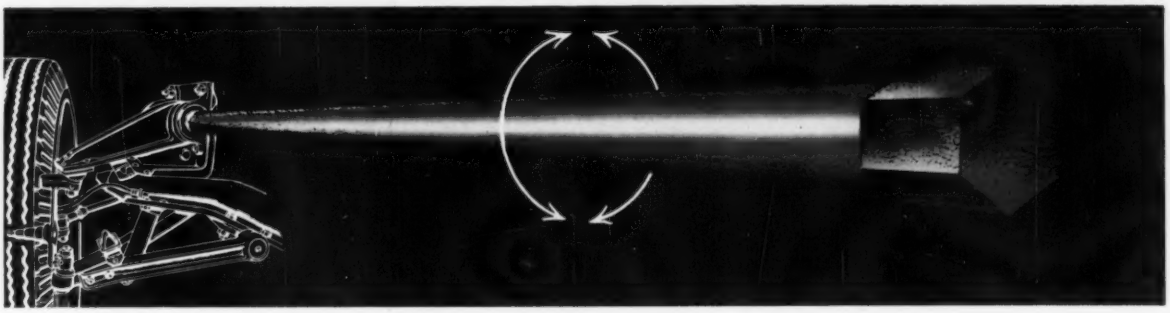
CPA-59 (7/59)

ANNOUNCING
Chevrolet trucks for 1960 with total newness!

Here comes the biggest improvement in trucking in decades . . . a revolutionary improvement that can make any truck route in America a far smoother road to bigger profits for you. Turn the page for the hottest news for truckers since coffee was invented!

new torsion-spring ride!

THE SMOOTHEST THING THAT EVER CAME BETWEEN A ROAD AND A LOAD!



Independent front suspension with tough torsion bar springs . . . for trucks! Years in the making, this totally new suspension system protects everything from bumps and jolts . . . provides a new kind of performance that lengthens truck life, protects cargoes, reduces driver fatigue and cuts maintenance expense to new lows. Independently suspended, each front wheel steps cleanly over bumps. And the friction-free torsion bars work to absorb each jolt or jar; they flex freely, even on the smallest bumps, yet have the capacity to absorb severe shocks. The result is a truck ride so wonderfully smooth that it must be experienced to be believed! And it's now *standard* in *all* classes of 1960 Chevrolet trucks!

Three tailored-to-the-truck rear suspensions complement the revolutionary torsion bar independent front suspension. *In Series 10 and 20 models,* frictionless high-capacity coil springs ease the rear axle over bumps. *In Series 30* and 40 models,* a new two-stage leaf spring provides tailored springing action . . . *and in Series 50, 60, 70 and 80 models,* all-new variable-rate rear suspension gives spring resistance that adjusts automatically to cushion any size load.

**Optional at extra cost.*

Chevrolet trucks for '60

new style, new models!

NEWLY ENGINEERED FOR EXTRA SAVINGS THROUGH EXTRA STRENGTH!

Rolling in on revolutionary torsion springs, these 1960 Chevies are smooth as silk yet tough as nails . . . totally new in scores of profit-boosting ways! In the light-duty class, for example, big new Series 40 chassis-cabs and stakes add to your earning power with G.V.W's up to 14,000 lbs. And virtually every model offers a new lower-to-the-ground build (without sacrificing road clearance) which improves truck stability and makes cab entry easier. In the big-truck class, too, Chevy for '60 sports big-profit G.V.W.'s — up to 19,500 lbs. in middleweights and 36,000 lbs. in heavyweights — with stronger components including new frames with more massive bracing and brawnier side rails, new bigger brakes, and the latest in low-cost V8 or 6-cylinder power.

New Comfort-King Cabs! There's more comfort than ever before, with 5 inches more shoulder room, 6 inches more hip room and more leg room and head room, too! A new wider seat, combining S-wire, coil and flat spring elements, offers a new high in easy riding. And Chevy's new double-walled cowl and new double-panel roof construction provide extra ruggedness and long life.

New custom cabs! Available in all 1960 cab models, they include distinctive exterior door pillar and rear belt line moldings . . . handsome chrome grille (light-duty models) . . . new Super Cushion Seat with foam seat cushion and backrest . . . sunshade, armrest, cigar lighter and control knob trim.

New compact L.C.F. models! Twenty-six new Chevrolet Low Cab Forward models with short cab design allow for maximum length trailers and extra cargo space. Short wheelbase and turning radius give exceptional maneuverability. Bumper-to-back-of-cab dimension is as short as 90 inches. G.V.W.'s go up to 25,000 lbs. and new cab design makes entering easier. And in series 50 and 60 models you can choose 6-cylinder or V8 power.

New tougher built tandems! They're the best built Chevy tandems yet with Hendrickson RT320 rear suspension, two 16,000-lb. Eaton rear axles and 7,000-lb. front suspension (9,000-lb. front suspension optional, extra cost).

And they're POWERED to improve your profit picture, too! Chevy for '60 offers a *wide* choice of better-than-ever power plants; in every weight class you can choose from famous economy 6's or V8's that lead the field for efficient short-stroke design! Three big sixes and four advanced V8's allow you to match the engine to your job for top performance.

Chevy's 1960 trucks with *total newness* are now on display at your Chevrolet dealer's, so stop by sometime soon! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

CHEVROLET

with total newness!

USE SOUTHWIRE SINGLE SOURCE SERVICE

A quick glance at Southwire's list of products shows how you can save time, trouble, and money.

You'll find it a simple matter to deal with one source—one order, one bill, one check. And when you order from Southwire, you get Southwire service—the extra that means so much, but costs no more.

A phone call right now will bring our catalog, prices, delivery schedules to your desk.

ALUMINUM • COPPER • STEEL STRAND

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- NM Sheathed Cable
- Cable Accessories

- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

Southwire Company

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SOUTHWIRE serves the world

LIFETIME SERVICE BACKS UP OCOTILLO'S NEW LJUNGSTROMS®

Extremely compact and highly efficient, these baskets of heat transfer surfaces are the heart of the Ljungstrom. (The photo below shows one being lifted into position.) Every inch of these baskets is the approximate equivalent of one foot of a standard tubular heat exchanger. The combined surface of the Ocotillo Air Preheaters provides 263,600 sq ft of heating surface.

The new Ocotillo Power Plant, near Tempe, Ariz., employs four Ljungstrom Air Preheaters for its two 835,000 lbs/hr boilers. Dependability is built into these Ljungstroms, from their corrosion-resistance to their double-life reversible elements (shown in the photo above).

But one of the most important reasons why Ocotillo chose Ljungstrom is Lifetime Air Preheater Service. Throughout the life of each unit (units dating from 1923 are still in operation), Air Preheater engineers make regular calls to inspect the units and keep them in top operating condition.

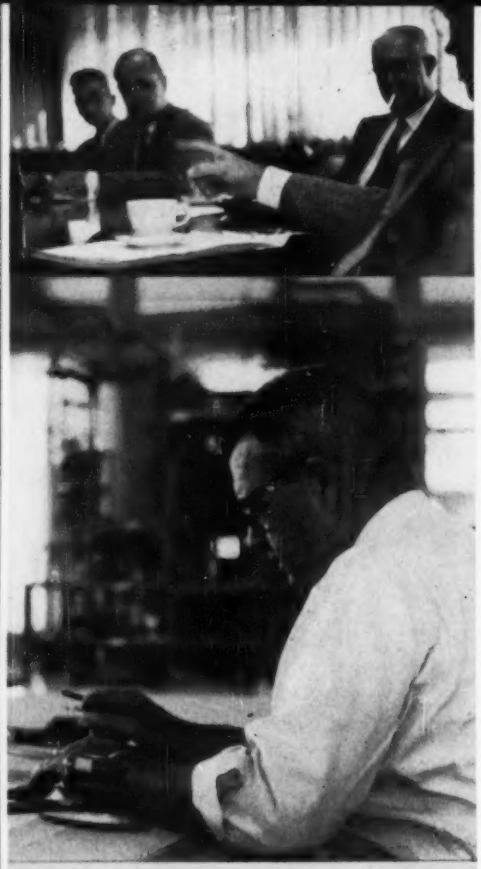
What's more, Air Preheater provides rapid factory service, too. Here's an example: a customer called on a Friday morning requesting immediate shipment of cold-end seals for an Air Preheater. But regular fabrication time would take until the weekend, when no ordinary transportation would be available.

So Air Preheater went to work. Special trucking was arranged. And by a tremendous effort, fabrication was completed *on the same day the order was received . . .* and the customer received the necessary parts *only ten hours after his initial request.*

Fast response to emergencies and regular inspection throughout the life of each Ljungstrom installation are two of the many advantages Air Preheater provides its customers. Another is expert knowledge of boiler and preheater problems—and how to lick them—gained from over 35 years' experience. Perhaps these reasons explain why nine out of ten preheaters sold today are Ljungstroms.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.



When you consider expansion . . . the most important investment you can make is in the creative ability of men.

FLUOR

Engineers and Constructors

Design in three dimensions

At Fluor's Los Angeles headquarters, there is an 8,000-square-foot building where 30 plant designers work with 20 professional modelmakers. Drafting tables are within 10 feet of model assembly tables. Another building contains an elaborate photographic studio where precisely scaled isometric and plan views can be taken under shadowless lighting.

All this began seven years ago when Fluor engineers built a scale model and rigged miniature hoists to solve a difficult erection problem. Success of this trial led to experiments with the use of models as a basic design tool. Cost studies showed substantial savings in drafting man-hours (net savings, above modelmaking costs.)

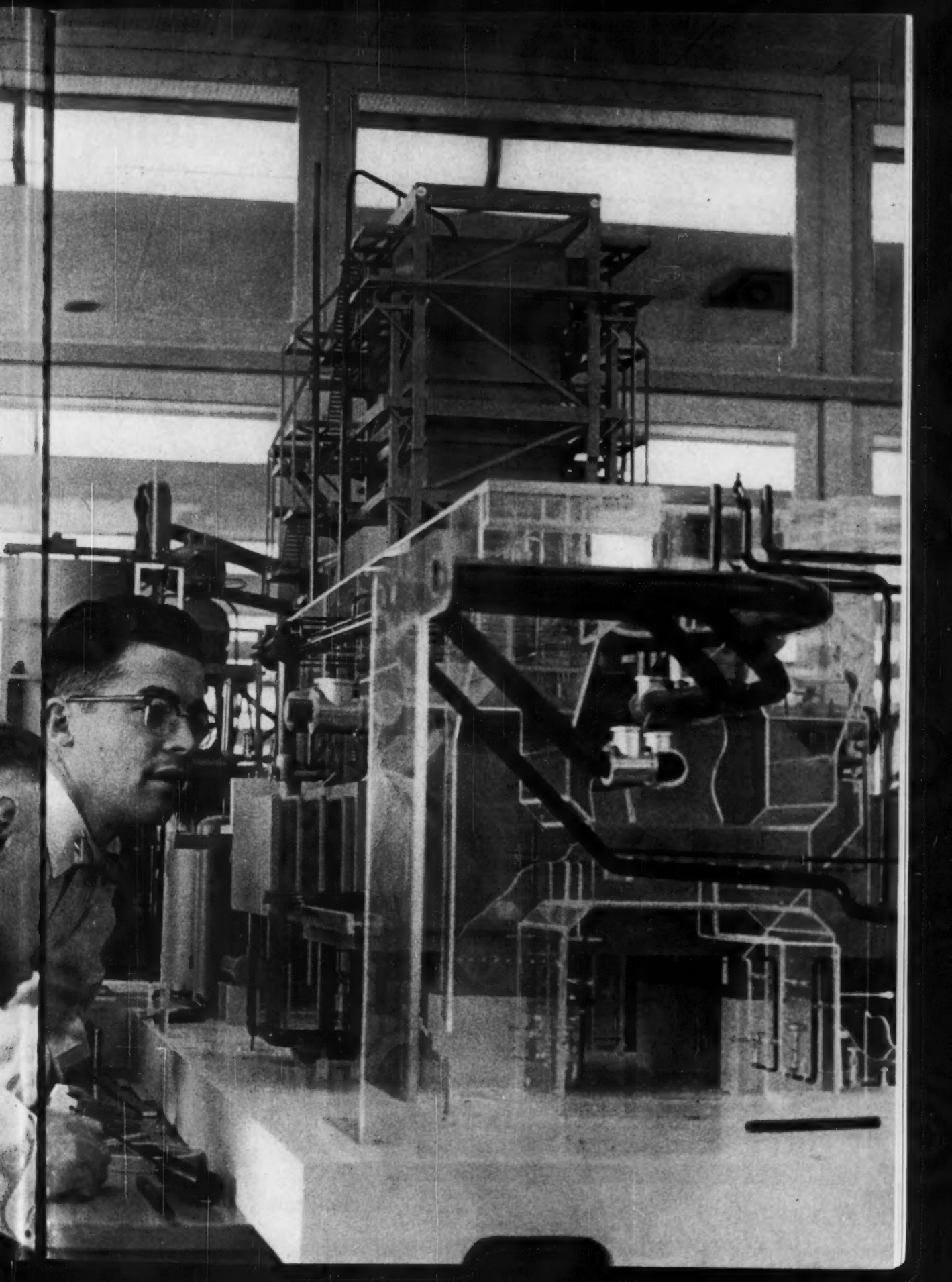
Today, models are to be found in most of Fluor's drafting rooms, and nearly all Fluor-built plants are designed with the aid of this tool. Beyond the dollar savings there are many less tangible benefits. Sizable groups can confer over a model, reach quick agreement on layouts, approve or revise many details at a single session.

Piping runs are shorter and more direct, valves and instruments are more accessible when designers lay them out on a model (a Fluor comparison study of a refinery design showed a $50,000 saving in pipe, fittings and fabrication by use of a model vs. conventional layout drawings.)

Costly revisions are minimized when many specialists can study a complete plant in miniature before construction begins. In the field, models serve as a reference for construction crews and a guide for operator training.

Unless scale models are properly used—as a basic, integrated design tool—most of these advantages are lost. The development and refinement by Fluor of design techniques using scale models has been a creative contribution to the engineering and construction industry.

For more information on the use of scale models in design and construction, write to Dept. 41, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.



Take Advantage of Kuhlman's

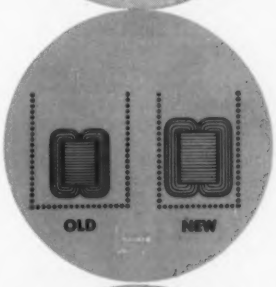
Big Bonus Year... Get More Transformer for Your Dollar—

MORE OF EVERYTHING NEW

New slim, trim look! Bigger core and coil; smaller, trimmer tank.

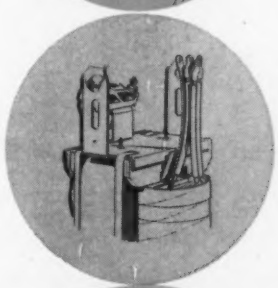
More copper—more steel—more economy—at no extra cost, no increase in weight.

Lower losses—more value—more bonus features. The biggest "value-packed" transformer ever offered by Kuhlman.



MORE PERFORMANCE

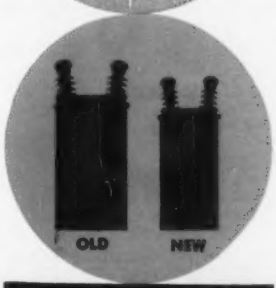
Lower exciting current—lower copper and core losses—improved impedance—better regulation—a new high in operating economy. This means less drain per transformer on your system—less revenue loss—more customer satisfaction.



NEW CONSTRUCTION

Mechanically stronger coil with greater specific dielectric strength. A newly developed thermo-setting insulation that bonds the windings into a tighter, more compact unit.

A new core and coil clamp that supports the coil independent of the core to give greater short circuit strength and less mechanical stress on the core.



SMALLER, TRIMMER TANK

A transformer bigger inside, yet smaller in all-over size. More transformer—more performance—more economy—in a smaller tank that takes up less room on the pole.

All this backed by Kuhlman's 65 years of proven reliability. All this at new, low prices.

It's Kuhlman's bonus year. You'll never get more for your transformer dollar. Ask your local Kuhlman representative for all the facts.

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Michigan

Manufacturers of transformers since 1894

PLANTS: Bay City, Mich.; Crystal Springs, Miss.; Salinas, Calif.

The Kariba Dam is being built on the Zambesi River to provide hydro-electric power for Central Africa.

Transmission equipment for this project is being manufactured by BICC. Altogether orders for this company total some ten million dollars and include a specially designed 330,000 volt single-conductor oil-filled cable which will connect the underground power house to the overhead transmission lines. This will be highest voltage cable ever installed in Africa.

the 330,000 volt Kariba Cable

the highest voltage in Africa

experience

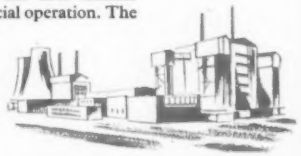
keeps BICC *in the lead*

D.S.O. FOR ECONOMY

The Ductless, Shaped-conductor Oil-filled cable is BICC's latest development in 33kV transmission. Dispensing with fillers and built-in ducts, it costs less than a conventional cable of equal duty.

CABLES FOR THE FIRST NUCLEAR POWER STATION

BICC supplied cables and accessories for Calder Hall, England, the first nuclear power station in commercial operation. The cables included specially designed types resistant to intense radiation and heat, for operating the fuel charging and discharging grabs.



THE FIRST I.P. CABLES IN SOUTH AMERICA

In face of fierce international competition BICC 69kV Impregnated Pressure Cables were selected for power transmission in and around fast-growing Porto Alegre, Brazil.

How do you learn about electric cables?

By making them, testing them, installing them, studying them in operation, finding new materials and better designs, and then starting all over again. Years of doing this for every type of electric cable and accessory — that's where BICC's experience came from. Here are some of the results.

BICC the World's largest cablemakers

BRITISH INSULATED CALLENDER'S CABLES LIMITED

Technical Representative in U.S.A., Arthur F. Coventry, 11 West 42nd Street, Suite 442, New York 36, N.Y.

TRIPLE LANE TUBE LAYOUT . . .

what it is and how it IMPROVES CONDENSER OPERATING EFFICIENCY

An informative advertisement from one of the nation's most experienced condenser manufacturers

Steam condenser efficiency depends on water temperature and condition, proper maintenance procedures and many other factors. One of the most important is the design of the condenser itself—and *this* is largely a function of tube sheet design.

Triple Lane Tube Layout, a development of C.H. Wheeler Manufacturing Company of Philadelphia, is making significant contributions to condenser operating efficiencies in public utilities and industrial plants throughout the country. Figure 1 shows a C.H. Wheeler Dual Bank Surface Condenser with Triple Lane Tube Layout.

This tube sheet design permits steam to travel through three separate pathways. As a consequence steam penetrates to all condensing surfaces and utilizes to the fullest extent the condensing capabilities of the steam condenser.

Figure 1: Typical C.H. Wheeler Condenser with Triple Lane Tube Layout.

Central location of the air cooler section, another C.H. Wheeler design feature, also improves steam travel. It reduces the depth of steam penetration and therefore reduces resistance to steam passage, achieving a new low in condenser pressure loss.

How Reverse Flow Improves Condenser Efficiency, Reduces Maintenance

Proper maintenance—keeping tubes and tube sheets free from foreign matter, algae and scale—helps keep condensers operating at peak efficiency. In some cases grass and twigs build up to a point where they would ordinarily have to be shoveled out! It is in such cases that C.H. Wheeler Reverse Flow solves time-consuming, expensive maintenance problems. Here's how it works:

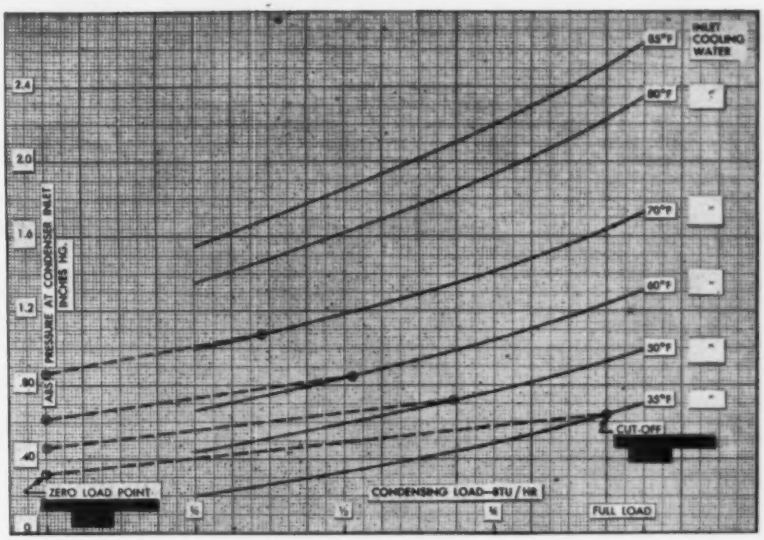


Figure 2: Typical condenser performance curves show how inlet cooling water temperature affects absolute pressure at condenser inlet at varying condensing loads. For a complimentary copy of the 38-page Condenser Handbook from which these curves are taken, write to C.H. Wheeler on your company letterhead.

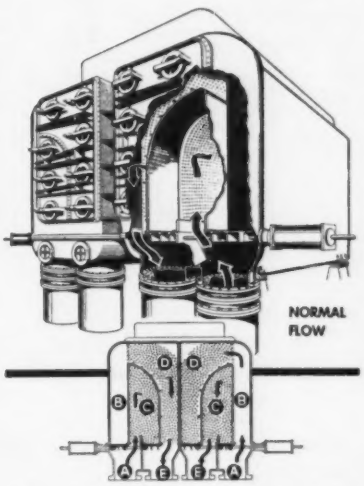


Figure 3: Diagram of C.H. Wheeler Reverse Flow which cleans tubes and sheets during full load operation.

Normal operation is shown on the left in the diagram in Figure 3. Water enters through inlet A with inside port open, flows through tube bank C to the rear of the condenser. It returns through tube bank D to the front of the condenser and discharges at E.

The right side of the diagram in Figure 3 shows Reverse Flow in operation in a C.H. Wheeler Dual Bank, Divided Water Box Condenser. Water enters through A with outside port open, flows up through channel B and through tube bank D to rear of condenser, returns through tube bank C to front of condenser and discharges at E.

Reversing can be accomplished during full load operation and full flow of circulating water, without additional pressure loss. Sluice gates for each half of the condenser move on a common stem. Each half of the condenser can be back-flushed independently; or both halves can be back-flushed simultaneously with one or two circulating pumps operating.

Because of more-than-half-a-century of experience in condenser design and maintenance, C.H. Wheeler is unusually well qualified to advise on condenser efficiency and maintenance problems. We invite your inquiry, whether you're concerned with condensers or with circulating and condensate pumps and other auxiliary equipment. A note on your company letterhead will receive prompt attention from us.

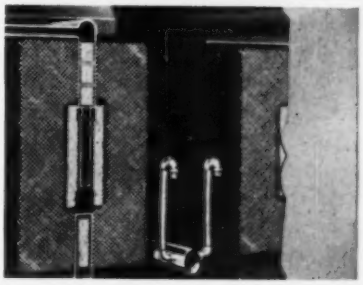


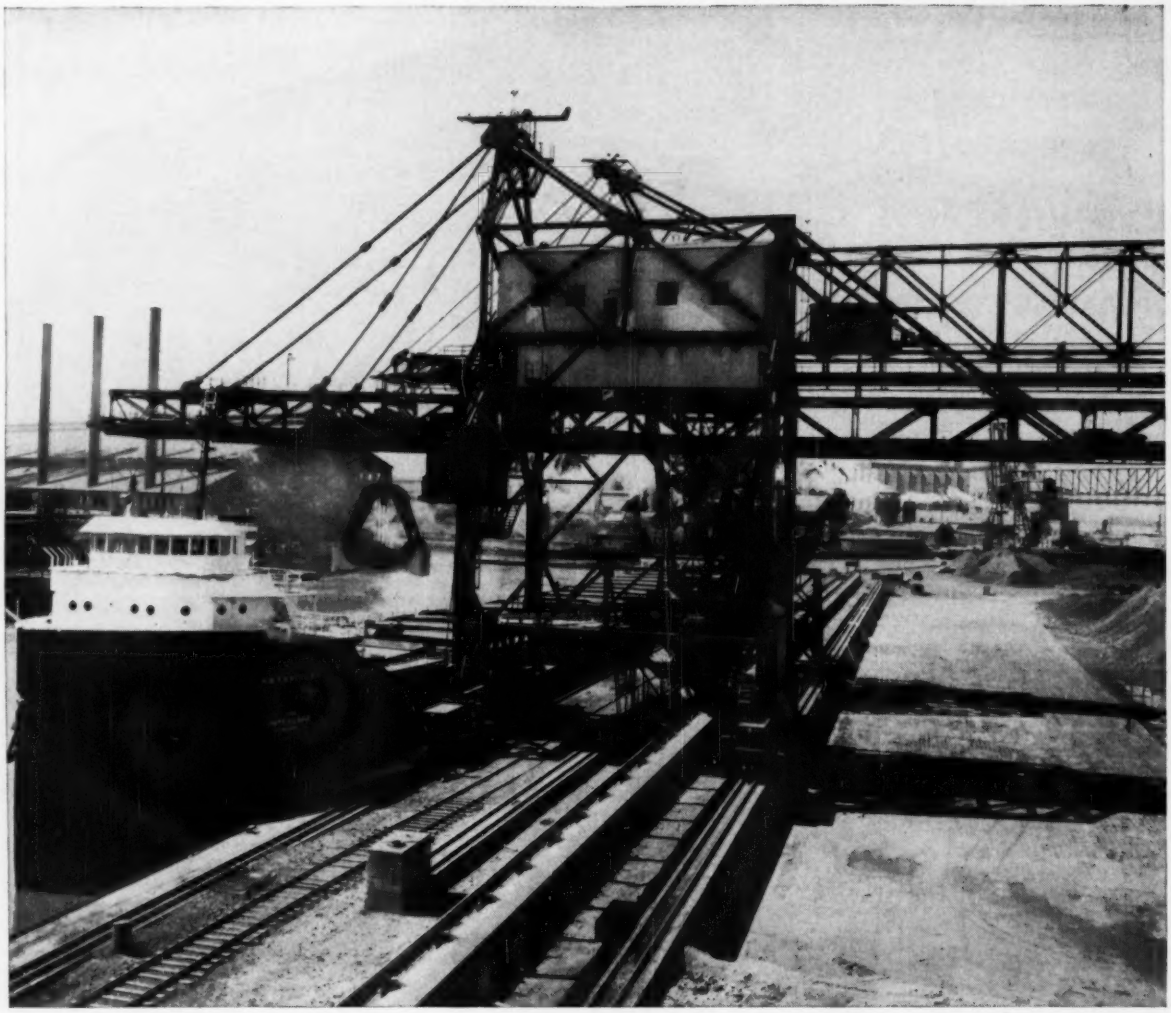
Figure 4: Central location of air cooler section in C.H. Wheeler Condensers reduces depth of steam penetration and therefore lessens resistance to steam passage, achieving a new low in pressure loss in the condenser.

C. H. WHEELER MFG. CO.

19th and Lehigh Avenue • Philadelphia 32, Pennsylvania

Whenever you see the name C.H. Wheeler on a product, you know it's a quality product.

Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Components



New Dravo Man-Trolley Ore Unloader Handles 1,650 Gross Tons an Hour at Interlake Iron

A new Dravo boat unloader is removing ore from Great Lakes vessels at a peak rate of 1,650 gross tons an hour at Interlake Iron Corporation's Chicago Plant.

It is a part of a major dock and ore yard expansion program, and was built by Dravo under contract from Arthur G. McKee & Company. One feature of this new unloader is a ring-type turntable on the man-trolley. It facilitates hold clean-up by permitting 90-degree rotation of the bucket in either direction.

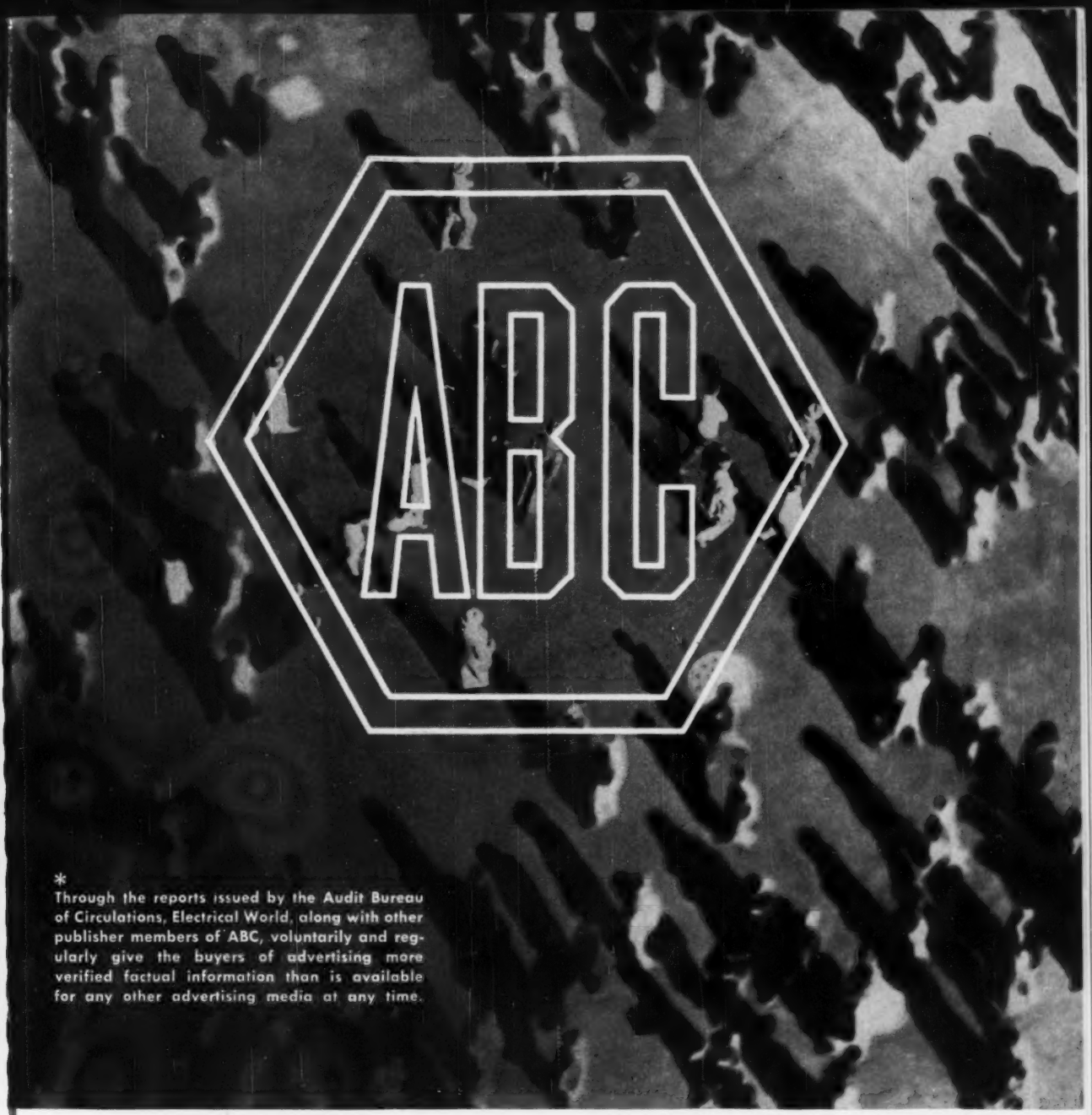
Dravo six-foot stroke, hydraulic buffers, located at either end of the man-trolley tracks, insure safe trolley stops in case of accidental over-run. Further protection is furnished by Dravo *Gale-Guard* rail clamps which automatically hold the structure to the rails whenever wind velocity exceeds 35 mph or when power is shut off.

Other specifications on this unloader include: Unloader Height: 100 feet. Man-trolley Speed: 960 feet per minute. Tower Speed: 115 feet per minute. Bucket Size: 300 cubic feet (18 gross tons).

Find out how Dravo's experience in ore and coal handling equipment can serve you. Write, wire, or telephone: Materials Handling Department, Dravo Corporation, Pittsburgh 25, Pennsylvania.

Towboats, barges, river transportation • slopes, shafts, tunnels • gas & oil pumping stations • ore & coal bridges • pumphouses & intakes • boiler & power plants • heaters • docks & unloaders • fabricated piping • bridge sub-structures • river sand & gravel • sintering plants • mill lubrication systems • locks & dams • process equipment • gantry and floating cranes • mechanical construction • marine repairs foundations • vibrating screens & conveyors • ready-mixed concrete • dredging • pile driving • grating

DRAVO
CORPORATION



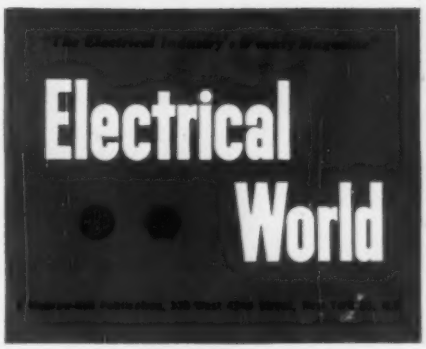
*
Through the reports issued by the Audit Bureau of Circulations, Electrical World, along with other publisher members of ABC, voluntarily and regularly give the buyers of advertising more verified factual information than is available for any other advertising media at any time.

Advertising works when the target is clear!

The sure way to get sharp definition of the audience for your product communication is through the Audit Bureau of Circulations*, of which Electrical World is a member.

Through independently audited ABC Reports you know your sales communication is focussed dead-center on the audience it's intended for, with no distortion or "fuzziness" around the edges. You know the size of this reader audience, who the reader is, where he is . . .

. . . and you know he pays to be in the picture every week through the informative pages of Electrical World *because it's of value to him.*



NOW Save costly man-hours, reduce downtime with the new E-M Straight-Up-Ventilated Boiler Feed Pump Motor. It gives you . . .

Quick and Easy Access

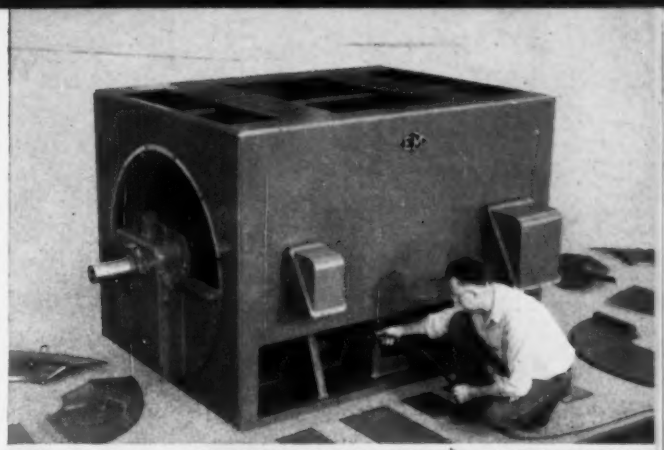
You don't need a hoist. Handy new E-M upper bracket is light, functional . . . easy to remove. Separate bearing housing cap stays on.

E-M 1300-TPA-2198

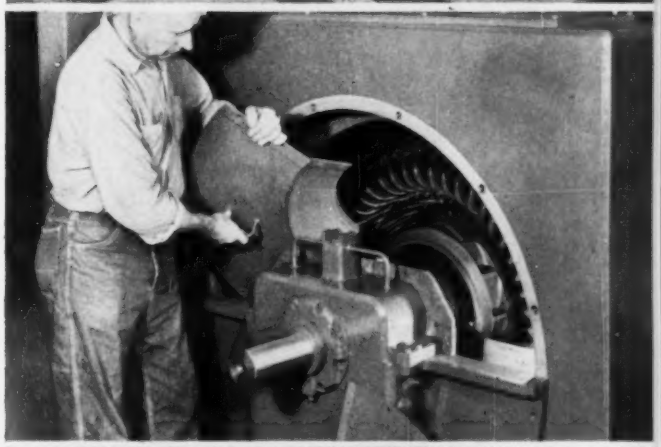
ELECTRIC MACHINERY

Builders of the new pump mo

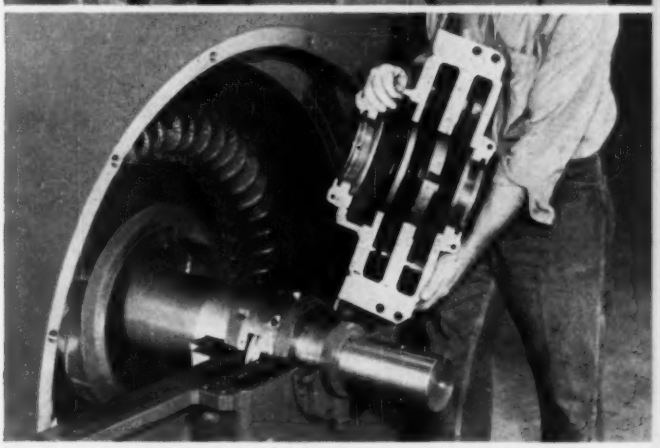
It's easy to remove louvers —just unbolt, lift off. Access plates let you clean thoroughly behind stator core.



Coils are readily checked for condition and cleanliness. Four-section air baffle comes out easily without taking off lower bearing bracket.

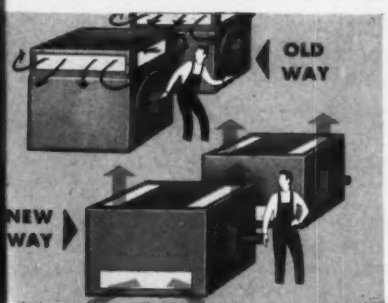


Just lift the cap to inspect bearings. Raise the rotor shaft to roll out the lower bearing half.

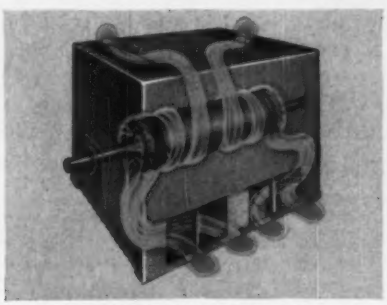


Learn more about the motor that's a pleasure to service. Ask your nearby E-M Sales Engineer and write to the factory for your copy of illustrated brochure No. 1134-W.

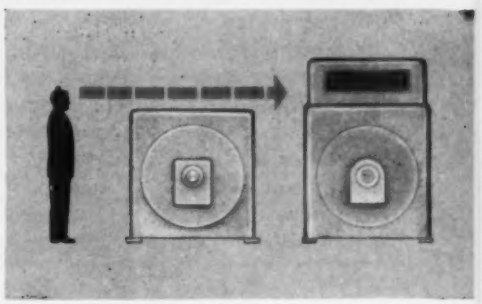
More of the MANY BIG DIFFERENCES that MAKE THE DIFFERENCE



STRAIGHT-UP-VENTILATION



AIR-FLOW ACOUSTICAL CONTROL



MINIMUM HEIGHT—MAXIMUM VISIBILITY

MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

that performs as well on the job as on the test stand

Now . . . you can

CHOOSE THE TYPE OF OPERATION YOU NEED

in Westinghouse low-voltage power circuit breakers

Westinghouse provides bonus value beyond specification.
Shown here are DB-50 power circuit breakers with . . .

1 manual closing

To match your requirements, Westinghouse now offers low-voltage, Type DB power circuit breakers with a choice of manual, electric solenoid, and new spring-manual closing.

The new spring mechanism is simple, sturdy and has been fully tested. It can be used with selective-delayed trips up to the full short-time rating of the breaker and is available on the DB-15, DB-25 and DB-50. Industry standards recommend electric operation on the two largest frame sizes.

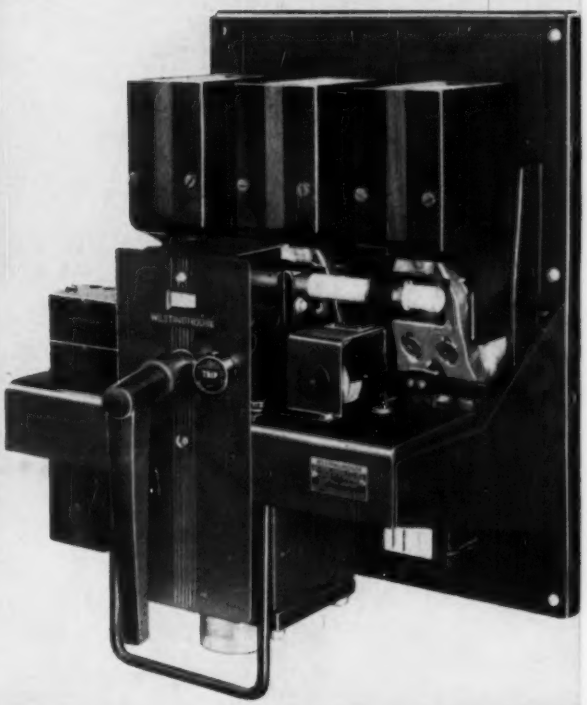
Westinghouse Type DB breakers give you ultimate protection and application flexibility for low-voltage power circuits. In addition to your choice of closing mechanisms, they adapt to any mounting —fixed, drawout or separate enclosure. All auxiliaries can be added in the field or at the factory before shipment. You get a selection of multiple tripping characteristics including: standard long delay and instantaneous; selective long delay and short delay; three-element long delay and short delay and instantaneous.

For more information on compact, versatile Westinghouse circuit breakers, contact your Westinghouse representative or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-60983

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS



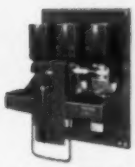
2 spring-manual closing

3 solenoid closing

You choose... the protection you need

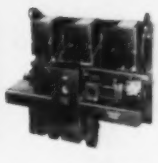
Type DB-15

Type DB-25



Type DB-50

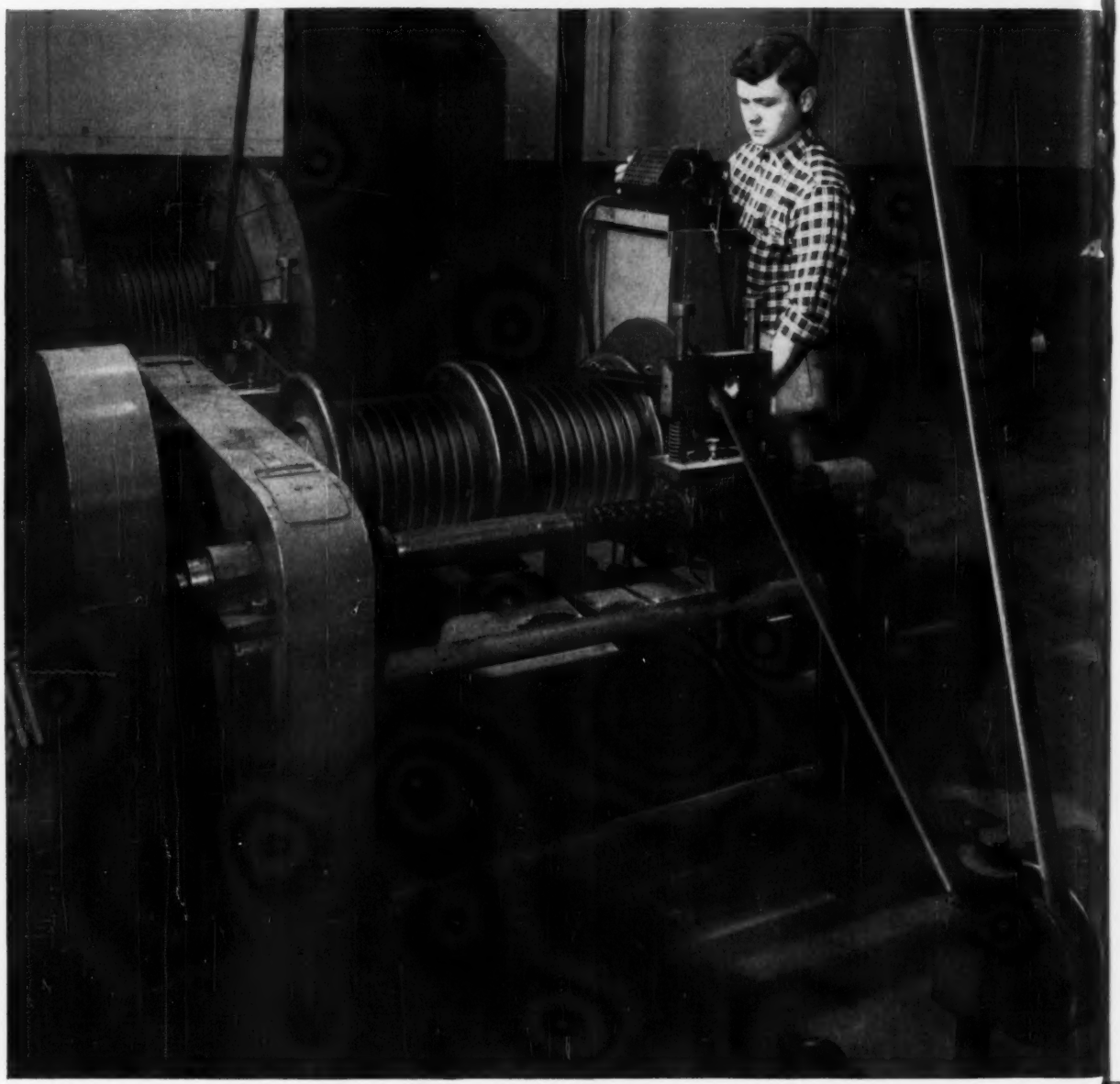
Type DB-75



Type DB-100

You select... the type of operation you want

Conventional Manual Closing		Quick-Make Spring-Manual Closing		Electric Solenoid Closing	
For Fixed Position Mtg.	For 3-Pos. Drawout Mtg.	For Fixed Position Mtg.	For 3-Pos. Drawout Mtg.	For Fixed Position Mtg.	For 3-Pos. Drawout Mtg.



Accelerated testing of cable. This machine, designed by AS&W engineers, is testing mining machine cable to determine its resistance to reeling and pay off under tension, abrasion, flexing under tension, kinking under tension. Just one of the ways to determine the best insulating and jacketing compounds.

From portable tools to the largest power shovels, Amerclad Cables offer safe dependable service.

It's how you mix ingredients in just the right proportions that makes a big difference in cable performance.

USS **Tiger Brand Electrical Wire & Cable**

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical cable?

In USS Tiger Brand Amerclad it's better engineering and quality construction

Engineered for the job. USS Tiger Brand Amerclad Cables are used in such a variety of applications that "engineering for the job" becomes extremely important. Special constructions are designed for electric shovels, dredges, mining machines, welders and portable tools. Cable life depends on how well the engineers have anticipated all the destructive forces that a cable encounters in service.

Quality construction. USS Amerclad's highly flexible construction—rubber insulated conductors and Amerprene jacket—is carefully designed to give you superior electrical performance and mechanical reliability. Dynamically balanced rope lay conductors, as opposed to loosely bunched groups of fine wires, give balanced performance and long, trouble-free service through elimination of unequal tension and elongation.

Each conductor is separately insulated with Amerite, a tough heat-resisting, special rubber compound that exceeds the requirements of ASTM, and other industry standards. A rugged abrasion resisting Amerprene jacket protects the cable from mechanical abuse.

Tiger Brand Amerclad Cables are as tough as they come. They soak up shock and vibration, withstand crushing impact, severe jerking and pulling for unbelievably long periods. Used outdoors for mining, quarrying and excavating machines, Amerclad resists the constant wear and abuse from contact with rocky ground. And installed on lighter indoor equipment—electric welders, shop tools and motor leads—Amerclad gives top performance even when it's dragged over rough floors, through oil, grease or water.

Amerclad's greater durability will pay for itself many times in unfailing service, and ability to handle rated loads. It's the toughest electrical cord and cable money can buy.

Send for catalog. The Tiger Brand Amerclad Cable story is told completely in our new book we've reserved for you. We'll send the book without cost or obligation. American Steel & Wire, Dept. 9290, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

USS, Amerclad, Amerite, Amerprene and Tiger Brand are registered trademarks

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

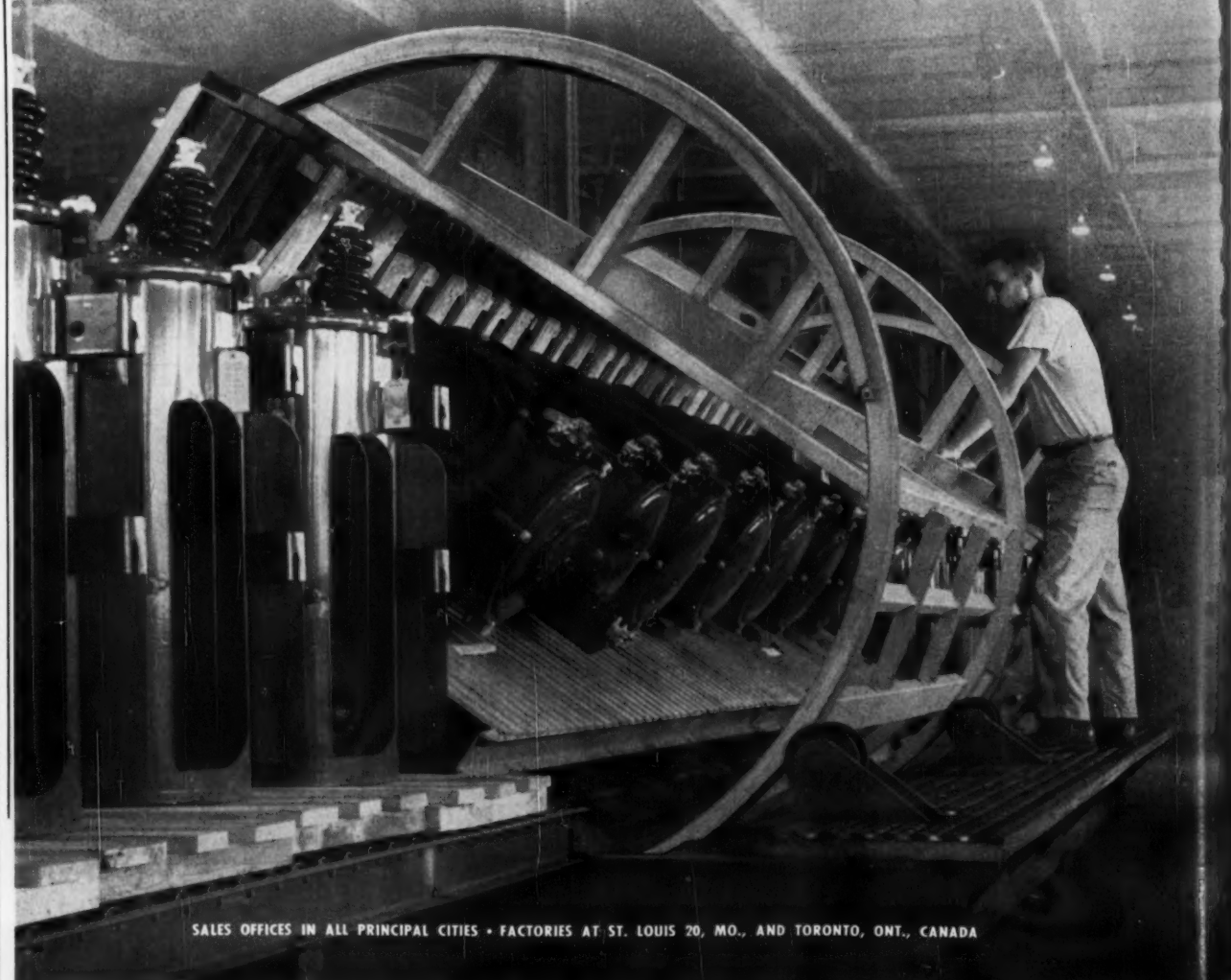
bottoms up for top performance

Moloney literally turns things upside down to assure long life and trouble-free performance of its distribution transformers. As a final check, following a rugged series of automatic, electronic tests to determine the equipment's compliance with EEI-NEMA and Moloney standards, each transformer is inverted so that the oil presses against all sealing gaskets. Every point must be leak-proof, to keep oil in; moisture and other foreign matter out.

This is just another example of how Moloney Electric Company designs and builds transformers to stay in service longer. Take advantage of Moloney's more that sixty years of experience in the manufacture of only one product—transformers . . .
Make it Moloney All Along The Line.

MES8-30

MOLONEY ELECTRIC COMPANY



SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA

Fixed Charges Need Critical Review

Fixed charges, rather than operating costs, are today exerting the dominant influence over the cost of energy produced by modern steam stations. This fact stands out conspicuously among the conclusions that can be derived from Electrical World's 11th Steam Station Cost Survey in this issue. The magnitude of these carrying charges, the wide fluctuations in them among the 55 reporting stations, and the factors that appear to magnify these fluctuations, merit full study by all elements of the industry concerned with continued reduction in the cost of energy.

Thanks to the stable high level of today's steam cycle efficiency, the production cost component of energy falls within a well-defined and comparatively stable band ranging from a high of 6 to a low of 2 mills per net kwhr. This 3:1 ratio is today being achieved in the face of a 6:1 variation in the fuel component of production cost.

On the other hand however, fixed charges for the 55 stations, participating in the survey, fluctuated rather erratically within a broad band of cost ranging from a high of 7 to a low of 0.75 mills per net kwhr . . . a 9:1 ratio. Moreover at both these extremes, carrying charges were the determining factor that established the lowest and the highest energy cost per net kwhr for the survey . . . 3 mills and 12 mills respectively.

Among the factors that contributed to the fluctuations in carrying charges, two stand out as perhaps more significant than the others. They are station investment, and the percentage value used in computing fixed charges.

Comparatively high station investment per kilowatt is unavoidable and understandable in a period of high material, equipment and labor costs like the present. The current survey shows that the cost of building new stations today, although down slightly from 1956, still ranges from a low of $87 to a high of $230 per kilowatt. As far as carrying charges are concerned this is a significant variation. Moreover, it is one that has been accentuated by design economies permissible in southern, gas-fired stations. Northern utilities have yet to find comparable economies for coal-fired stations.

The percentages that are being applied to these values of station investment in computing the fixed-charge component of energy cost also vary widely. The average percentage used by reporting stations was 13%. Of course the survey sample includes several power plants owned by Federal and municipal authorities, for which the percentages ranged downward to a low of 2.8%. For the remaining plants, owned by electric light and power companies, carrying charges were computed on percentages ranging from 9 to 18%. Whatever the ownership, however, two out of three stations used 13% or higher to compute fixed charges . . . one in four reporting stations used 15% or *higher*.

As we see it, today's high plant investment, growing out of inflation, taken together with the high fixed charge rates in use, are exerting a leverage on energy cost that merits serious and detailed analysis. The situation calls for particularly careful review of those components of fixed charges under management control.

A New Tack on Cutting Fuel Costs

- **Tampa Electric teams with coal and chemical companies to ship coal in and phosphate products out of the area**

- **Tanker will have 800,000-tons per year capacity; when not used for coal or phosphate, it will haul other products**

Tampa Electric Co has launched a new sea-going attack on fuel transportation costs. The offensive is expected to trim fuel costs by at least 10% per million Btu.

In essence, the new method merely adapts the utility's successful use of phosphate freight cars to bring coal back to Tampa by rail. Now, this will be supplemented by a tanker with an annual coal-hauling capacity of 800,000 tons, plus 64 all-steel barges.

A joint approach on the sea-faring assault finds Tampa Electric teamed with Virginia-Carolina Chemical Co and Peabody Coal Co. They have formed two shipping firms—Gulf Transit Co and Mid-South Towing Co—to handle the operation.

Main purpose for the formation of the two shipping firms is for transportation of coal for the utility's Gannon steam station and of phosphate products from Tampa to principal ports on the Gulf Coast and to the Ohio, Illinois, and Mississippi river systems.

Vessels to Haul Sulphur, Too

"When vessels operated by the two firms are not being utilized for transportation of phosphate from Tampa and a return load of coal for our Gannon plant, they will be used to haul sulphur and other bulk exempt commodities," says William C. MacInnes, president of the utility. MacInnes is a member of the board of directors of both the shipping firms.

Tampa Electric will continue to receive some of its Gannon plant coal requirements by rail, he points out.

Noble Gordon, president of Mid-American Transportation Co, has been elected president of both Gulf Transit and Mid-South Towing.

The Gannon plant, where construction of a third generating unit recently started, has been getting coal on a return haul by phosphate rail cars since the plant began operating. For years, the phosphate cars had returned to Tampa empty after hauling phosphate products away.

"Our two-way haul arrangement both by water and by rail has been very satisfactory, and has resulted in considerable savings . . ." MacInnes says. "These savings have been passed on 100% to Tampa Electric Co's customers under the fuel clause arrangement in our rate schedule.

"We expect that, with our new shipping arrangements, savings can be realized to the extent that our fuel costs will be reduced from the current 33.6¢ per million Btu to well below 30¢ per million Btu," he declares.

Gulf Transit Co's initial equipment will consist of one T-2 tanker, the S. S. Manhattan, which has been purchased from Standard Oil Co of New Jersey. The tanker is undergoing conversion to a bulk cargo vessel with loading and unloading facilities.

When completed, the tanker will have a deadweight of 16,600 tons and a minimum bulk cargo capacity of 14,000 tons of coal. The S. S. Manhattan is over 500 ft long and has a 68.2-ft beam and a 28.2-ft draft. "It is powered by a 6,000-hp steam turbine."

Two electrically powered cranes, each with about a 950-ton per hour free digging capacity, and a conveyor boom will permit loading or unloading from either side of the vessel alongside shore facilities or barges.

This equipment will handle virtually all types of bulk items, including coal, phosphate, sulphur, scrap pig iron, grain, and structural steel.

Communication and navigation equipment on the vessel will enable it to operate on any ocean trade, including the St. Lawrence Seaway and the Great Lakes. When the tanker has been converted, it will be re-christened the "Martha Mac."

Mid-South Towing Co's initial equipment will consist of 64 all-steel jumbo open hopper barges, one all-steel 3,200-hp screw diesel towboat, and 48 self-stacking all-steel removable barge covers.

The 156-ft long towboat has a 35-ft beam and a draft of 8 ft. Two Fairbanks Morse 10-cyl, 1,600-hp marine diesel engines will power the vessel. It will boast the latest safety devices such as emergency shut-offs for blowers, governors, and fuel oil located outside the engine room.

Two-way communication by long-range radio, two-way radio and Bell mobile phone will be augmented by radar and modern navigational aids on the towboat. Its crewmembers will enjoy air conditioning and a soundproofed engine room. The "Girlie Knight" will be the towboat's name.

The 64 barges each will have tow knees on the bow or rake end for assemblying tows of varying drafts. The self-stacking barge covers are needed for certain phosphate products and grain.

To assure an economical opera-

TVA Signs 15-Year Pact

A 15-year contract for the largest single coal purchase agreement in its history was announced by the Tennessee Valley Authority last month. West Kentucky Coal Co will be the supplier of 850,000 tons a year, under terms of the agreement. This represents $36,976,914 worth of coal for the 15-year period.

TVA also signed contracts with other coal suppliers for 11,330,660 tons of coal costing $32,206,000. These agreements call for deliveries from fields in east Tennessee and eastern and western Kentucky over periods of five years or more.

tion for hauling their respective coal and phosphate products, the three sponsors have negotiated long-term agreements.

Observes MacInnes: "This arrangement will assure the availability of the necessary transportation equipment and related facilities for the expanding shipping requirements for Tampa Electric and Virginia-Carolina Chemical."

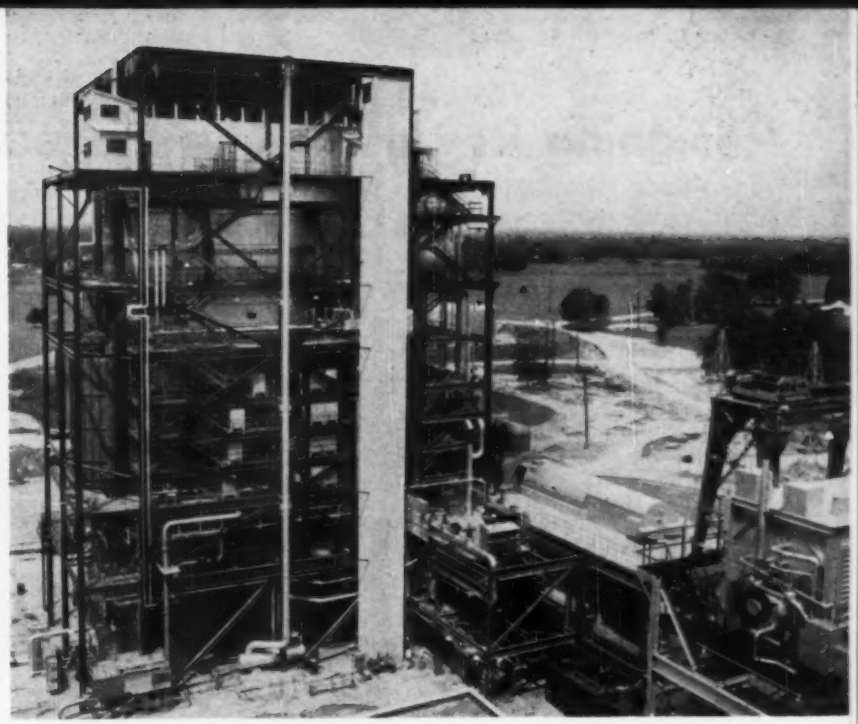
Rate Hike Granted

Prior to the agreement announcement, Tampa received approval from the Florida Railroad & Public Utilities Commission to put into effect a $1,585,000 a year rate increase. On July 7, the commission issued its order authorizing the company to put such an increase into effect. The company was directed to file appropriate tariff changes, which it did. On July 31, these tariff changes were disapproved because "the utility sought to impose the entire increase of $1,585,000 on its residential and small commercial customers."

The commission further said that "in its order disapproving the proposed tariff changes the commission reviewed the policy it has adhered to since 1953 of maintaining a competitive rate situation between Tampa Electric Co and Florida Power Corp in the phosphate mining area where both companies provide similar service, and called attention to the fact that Tampa's rates for that service in said area are now substantially lower than Florida Power's. For the purpose of reinstating the former competitive relationship the commission directed Tampa to use for that purpose so much of the authorized increase as might be necessary and then spread the remainder equally among its other classes of service."

Since then, the commission has approved the new tariffs leaving the furnace rate for phosphate mining firms as it is, with a very minor adjustment. This will improve the company's opportunity to secure a considerable amount of prospective new load, which it was about to lose because of the contemplated increase in the rate.

The new rates are effective with meter readings on and after Sept. 21.



Plant Building Forges Ahead

Despite the steel strike, the utility industry's construction program is forging ahead. Items:

• Speedy construction was a factor emphasized at Potomac Electric Power Co's dedication ceremony for the new Dickerson, Md., steam station about 35 miles up the Potomac River from Washington, D. C. R. Roy Dunn, Pepco president, told some 500 guests that the first 175-Mw unit, which went on the line in June, will be joined by a second unit of the same size in April 1960.

Dickerson's first unit, the largest and most efficient in the state, cost $37 million, Dunn said. Boilers can be converted from coal to oil or gas. Located on a 1,002-acre tract, the plant has been built high enough above the Potomac to permit a 50-ft rise in water level, on the possibility that a federal dam may be built across the river.

The plant requires Pepco to transmit power for the first time. About 55 miles of 230-kv line will bring Dickerson power into Pepco service areas.

• A 238-Mw unit was dedicated Sept. 25 at Mississippi Power & Light Co's Rex Brown steam plant (shown above). The addition, which began operating July 10, is more than twice the size of any other MP&L units and the largest yet constructed on the system of the parent firm, Middle South Utilities, Inc. Mark W. Cresap, Jr, president and chief executive officer of Westinghouse Electric Corp, was the featured speaker at the ceremonies.

• Consumers Power Co's first 265-Mw unit at the Dan E. Karn plant is officially on the line, following three weeks of test operation. The addition boosts Consumers' generating capacity to 2,270 Mw.

A second Karn plant unit of the same capacity is scheduled to go into service in 1961. The new plant adjoins the 614.5-Mw John C. Weadock plant on Saginaw Bay. Another 265-Mw set is under way at a new Port Sheldon plant west of Grand Rapids.

• Cleveland Electric Illuminating Co held open houses for employees, business and civic leaders, and for the public late last month for the $29-million addition to its Ashtabula plant. The new 250-Mw unit doubles the plant's capability.

• Orders for two steam units totaling 805 Mw of capacity were made by Commonwealth Edison Co late last month. General Electric Co will supply the utility with a 500 Mw machine for the Will County station near Lemont. Westinghouse will deliver the 305-Mw unit for the State Line station at the Illinois-Indiana boundary.

Resigning Regulator Lashes Federal Agencies

Hector of CAB would abolish Congressional commissions, but an FPC official says his plan is "for the birds"

The competency of independent federal regulatory agencies, including the Federal Power Commission, has blown into a Washington controversy as the result of an attack by a resigning member of the Civil Aeronautics Board.

Louis J. Hector, just resigned from the CAB, sent a 75-page memorandum to President Eisenhower saying he is convinced "that an independent regulatory commission is not competent in these days to regulate a vital national industry in the public interest."

Although his report dealt primarily with the CAB, he emphasized that the issue applies generally to all such agencies.

Hector's solution to the problem would be to abolish Congressionally established commissions and transfer their functions to one of three new or existing bodies:

1. "Transfer policy-making, planning and administration . . . to an executive agency . . .

2. "Transfer the judicial and appellate duties . . . to a true administrative court.

3. "Transfer the duties of investigation and prosecution to an executive agency such as the Department of Justice."

'Unable to Form Clear Policy'

Using the existing CAB as an example, Hector points out, "It is unable to form clear policy. It is unable to make sound and comprehensive plans. It is unable to administer its affairs with vigor and dispatch. As a lawyer, I have been disturbed at the inability of an administrative agency . . . to give a true judicial hearing to parties who come before it in litigated cases . . . The policies and plans of the CAB are not coordinated with those of other agencies . . . They are not responsive to the general policies of the President . . ."

Hector charges that the agencies —because they combine policy-making and judicial duties—are unable to do either job well. This overlapping creates a natural opportunity for charges of unethical practices, he claims.

His basic complaints are against slowness, inefficiency, and a lack of clear policy and planning. Formulating "broad plans and general policies . . . is more important than the decision of specific litigated cases." He cited one airline case which the CAB turned over to an examiner, waited two years for his recommendation, and then rewrote it.

HECTOR: A 75-page indictment

This complaint fits neatly with the drawn-out FPC consideration of Snake River development by the Northwest Power Corp. As of last week, the group's application had not been officially scheduled for consideration of plans for Mountain Sheep and Pleasant Valley.

"If a private business tried to conduct its affairs this way, it would go broke," Hector says. "If the federal government tried to formulate its foreign policy or its military strategy this way, the U. S. would never have become a great nation."

The issues raised by Hector are not new ones. Most recently, the House Legislative Oversight Subcommittee held hearings into how the agencies could achieve more efficiency and reduce chances of improper influence.

It would take an upheaval to change the present quasi-judicial system. And Hector, apparently, may not be the man to create it. He has been characterized as a bright, young lawyer, whose attack may be more vindictive than thought out in several areas.

Congress appears to be working on changes to the regulatory bodies in almost the opposite direction. That is, Congress—through expressions at several committee hearings —has given the impression it would like to see the regulatory agencies bound a little closer to Capitol Hill and pulled away from possible Presidential influence.

This was evident at a 1958 hearing on the renomination of FPC Chairman Jerome Kuykendall.

The Hector report has been referred to the Commerce Department. The House Legislative Oversight Subcommittee probably will hold another inquiry on ethical practices among the agencies with the Hector report as its theme.

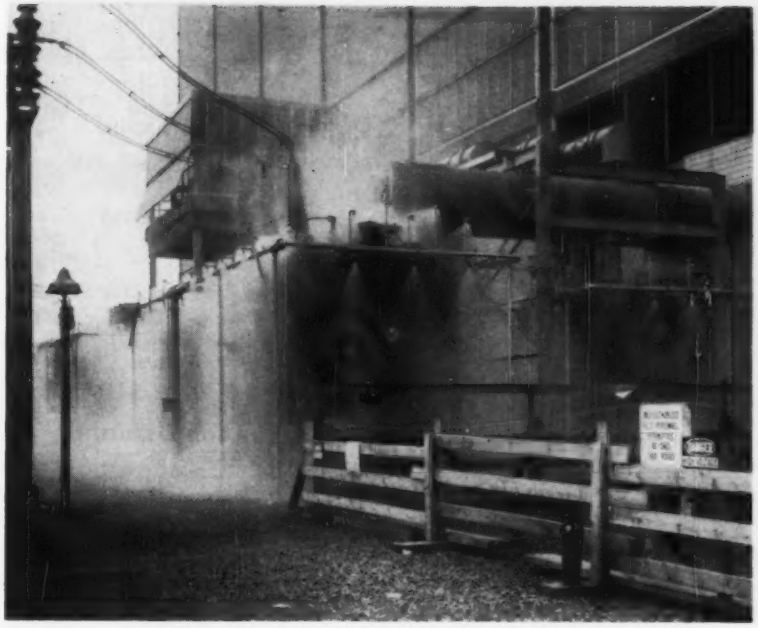
FPC Opposes Plan

Hector's idea doesn't sit well, naturally, with FPC officials. "It's for the birds," was the comment of FPC General Counsel Willard Gatchell. Gatchell claims that separation of FPC's policy-making and judicial sections would create a hopeless confusion of litigation.

Kuykendall feels strongly also that the FPC should be continued as a separate regulatory agency because of its unique responsibility. And he opposes the idea of creating a purely judicial court out of the FPC.

Both Gatchell and Kuykendall feel that creation of a new or separated series of agencies in the Executive branch would not correct inefficiencies—it would transfer problems to the new agency. They feel, instead, that Congress should draft revised legislation to expedite procedures at the FPC.

Hector, however, recognizes these views, pointing out that "most of the current discussion," in Congress and the agencies, "is devoted to further procedural improvements in existing agencies. It is my belief . . . that a far more basic and radical reorganization is required . . ."



Plant Safeguards Feature Cooling Link

Philadelphia Electric Co's new Unit No. 1 at Eddystone generating station will be placed in operation before 1960. As part of the over-all fire protection system there, the company recently completed tests of four water-spray installations which will safeguard transformers and other oil-filled equipment.

Two 200/350-Mva main transformers—one of which is shown above—are protected by the new spray system. The oil-cooling systems for the transformers are linked so that, if either unit fails, cooling capacity for both can be used to provide cooling for the surviving transformer. The switchover can be made by closing valves at the damaged transformer, flushing with clean oil, and opening valves between the cooler groups of the two units. Since both oil-cooling systems are protected by water spray, their continuing usefulness is considered to be fully protected, PE says. Grinnell Co, Inc, made, engineered and installed the four new systems.

Dresden Gets Conditional License

A conditional license has been granted for Commonwealth Edison Co's Dresden plant by the Atomic Energy Commission. The permit authorizes low-power operation, which must be analyzed in the interest of safety before output is increased above 1 tMw, AEC said.

Within 45 days of the authorization, the advisability of granting a provisional license will be considered by AEC. The decision will hinge on reports from the Advisory Committee on Reactor Safeguards and the views of participants on the project.

In an earlier hearing, the agency's staff counsel, Herzel Plaine, also agreed to the principle that construction on the 180,000-ekw reactor at Grundy, Ill. had gone on as far as necessary under the original construction permit.

Previously, Jensch had doubted the legality of approving CE's request to operate, at this point in the game, after the company had admitted that construction and installation of generating and in-core neutron monitoring systems weren't fully completed nor engineered.

CE and Plaine objected to the suggested 45-day period as a condition to permanent licensing.

Improve PR . . .

. . . on ownership and rates, Virginia meeting is told

Failure in handling people has led to the privately owned utilities' loss of ground *vis-a-vis* public power, the Public Utilities Assn of the Virginias was told at its recent meeting at White Sulphur Springs, Va. The association elected H. A. Hitch, Virginia Electric & Power Co, president for 1960.

"The problem of handling people —employees, suppliers, customers, stockholders, political leaders—is very real and very serious, and should bring out a major effort of today's utility management," said Loyal Phillips, publisher and editor of The St. Petersburg (Fla.) Independent.

Although at least two-thirds of the people today favor free enterprise and the privately owned utilities, he said, the utilities continue to lose the battle to public power. In the past 30 years, the share of the power industry falling into government hands, he noted, has risen from 7 to 25%. It is high time for each utility to set up and vigorously pursue a public relations program solidly backed by management, Phillips urged.

Myron R. Renick, chairman, Public Service Commission of West Virginia, also recommended a more effective program of public relations in view of probable rate increases, if inflationary trends persist. Working committees made the following reports:

1. Although the regional utility accident-frequency rate is up slightly to 4.09, including six deaths, it remains below the national rate of 6.39.

2. Member company programs should be tied into a regional program of public relations.

3. Sales groups should seek to promote both heat pump and resistance heating installations.

Other officers elected for 1960 were: E. C. Summers, Monongahela Power Co, first vice president; C. D. Lyon, Potomac Light & Power Co, second vice president; W. F. Keehne, Appalachian Power Co, treasurer; and R. W. McKinnon, executive secretary.

Powerscope

The TVA Scene

When it comes to Tennessee Valley Authority's power operations, there is one point of agreement from all ideological standpoints: That is, "There's rarely a dull day in the valley."

Preparations have begun, as one example, on a movie, which may be titled "Time and Tide," about the early days of TVA. Elia Kazan will direct it, according to 20th Century Fox. Filming will begin this fall along the Hiwassee River at Charleston, Tenn., and at Decatur and Cleveland, Tenn. The movie will be based on "Mud on the Stars," a novel by William Bradford Huie.

Back at Knoxville headquarters, Arnold R. Jones, a TVA director, was telling the Kiwanis Club: "Any time a friend of yours from the North says he's helping pay your light bill, tell him he isn't." TVA is operated on "business principles, and is self-supporting so far as power is concerned." He singled out Rep Ben Jensen (R-Iowa) as a detractor of the agency, but one who had sought federal funds for pork barrel projects in Iowa. Jensen's reply to this was, "He's nuts and tell him I said so . . . The government has spent in the neighborhood of $2-billion on that anti-American project."

All through the valley, meanwhile, expansions of industrial plants and automation has caused industrial demand to climb back from a recession dip, a dip that cut about 20% of TVA's heavy industry demand. The recovery saw 200 Mw of industrial load recouped early this year. Another 200 Mw is expected to be added by the end of 1959, officials in Chattanooga say, despite the impact of the long steel strike.

"For the next year to 18 months an even more dramatic demand growth of 300 to 350 Mw from heavy industry alone is in prospect," one statistician estimates. He points out a wide variety of industrial expansion projects are under way or planned in the area. The tender aspect of new industry moving there, some of which might be influenced by power costs, is not referred to, however.

Out on the fringes, unrest continues to build in a dozen or so communities that are served by private companies. In the latest development the Weakley County Municipal Electric System has begun overbuilding lines in South Fulton, Tenn., following an impasse on the sale of Kentucky Utilities Co's facilities there to the city. WCMES is a co-op headquartered in Martin, Tenn., served by Tennessee Valley Authority.

BPA Engineer Wins Medal

Konkordy V. Abakumoff has been awarded the Department of Interior's meritorious service award and silver medal for outstanding work with the Bonneville Power Administration. The honor recognizes his design layout for 345 kv and 287 kv autotransformer switching structures as a standard installation for the BPA transmission system.

Employed by the agency since 1941, Abakumoff is supervisory project engineer responsible for engineering and design of major substation facilities. Among other noteworthy assignments are his analysis and utilization of captured World War II German 230-kv airblast circuit breaker, and translation of important Russian technical literature in the power field.

Rate Change Okayed

Kentucky Power Co has received authorization to alter rates for the 86,000 residential, 12,000 commercial, and 85 industrial customers it serves in eastern Kentucky. The changes, which are subject to further Public Service Commission study and possible modification, will add $100,000 a year to revenues.

The new schedule ups the $1 minimum to $2, provides a fuel clause adjustment for residential and commercial customers' bills, and factors in higher coal costs for industrial customers. In addition, costs for promoting outdoor lighting and electric heating in schools are put into effect for the first time.

Sand Dunes Tapped

The process of utilizing water from sand dunes—an approach pioneered by Pacific Power & Light Co—will be used by a $5-million pulp and paper mill near North Bend, Ore. When completed in 1961, the mill will use materials from a nearby plywood plant and sawmill.

Glen Canyon Demand

The four states of the Upper Colorado River Basin have united in demanding the U. S. Bureau of Reclamation deal with them in allocation of power from Glen Canyon Dam. At an Upper Colorado River Commission meeting in Cheyenne, representatives from Wyoming, Utah and New Mexico joined with Colorado in urging Interior Secretary Seaton that no power allocation or transmission line construction be approved without giving the states a chance to review the program.

A regional director of U.S.B.R. said it would be several months before final transmission routes would be determined. A Salt Lake City meeting is planned between the U.S.B.R. and power companies in the four states and Arizona to discuss power allocations.

Flathead Follow-Up

In nearly all sections of the U. S. an additional unit at a steam or hydro project brings a degree of rejoicing. "Here's a new source of tax revenues," city fathers are apt to say. "New power reserve will help attract industry," business leaders might add.

The reaction differed for Montana Power Co when it completed the third unit at its Kerr hydroelectric project, which floods a portion of the Flathead Reservation. Although the addition of the third unit in December 1954 took no additional land, the Indians sought $50,000 more a year to go with the $175,000 MPC was paying them. Last month the Federal Power Commission ruled that the Flatheads should get the $50,000 extra, retroactive to the 1954 start-up.

King Tells PR Men: 'Stop Running Scared'

At PIP meeting, EEI President says public power threat should be dealt with dispassionately. Meeting notable for its candor

FRIENDLY OPPONENTS: Herschel Newsom, left, Master of The National Grange, shakes hands with EEI Pres Allen King. Between them is Mead Schenk, Interstate Power Co. Philadelphia Electric Co VP George Conover, right, looks on

Edison Electric Institute President Allen S. King recently told utility public relations men to "stop running scared" in their dealings with the problems of government encroachment in the electric power business.

At an Electric Companies Public Information Program (PIP) Workshop Conference that was markedly frank and fraught with self-criticism about investor-owned utilities' efforts to stem the public power tide, King cautioned his audience about getting "hysterical," and "losing your objectivity." The workshop was held in Philadelphia on Sept. 16-17.

King went on to cite a few statistics to show that the picture, from the private power viewpoint, was not always as bad as some of the industry's spokesmen had painted. But he emphasized that he was not minimizing the problem, merely trying to get the PR men to treat it objectively and dispassionately, rather than emotionally.

Then he went on to a few specifics. "Get the facts before your public in a simple, concise way that everyone can understand. Draw the kind of statistical comparison that cannot be refuted with jargon, and then aim that comparison to a specific audience." The EEI president drew on his own experience at Northern States Power Co to illustrate his point. In a digest-size leaflet titled, "NSP & Taxes," King has pointed out in separate editions aimed at his stockholders, employees, and the customers, a few facts easily understood by anyone (EW, Sept. 28, p 48).

In another address, notable also for its candidness, Herschel D. Newsom, Master of the National Grange and a long-time Indiana electric co-op farmer, called for a halt in the often bitter skirmishing between private companies and co-ops. "Now, I don't for a minute condone the belligerent, irresponsible actions of some co-op spokesmen, but you gentlemen must realize that every co-op man or public power advocate is not a socialist, either." Newsom, however, did not limit himself to criticizing the companies only. Even as a co-op founder, he doesn't think their positions are altogether fair. He opposes generally 2% money for generating facilities, and when asked specifically about the $53-million loan now in application for the Hoosier Cooperative Energy, Inc, he said he'd have to have more facts before he would buy the idea.

National Ads Criticized

But if utility public relations efforts were criticized, so too was its national advertising. Joseph R. Pahle, advertising manager of Chattanooga Gas Co, told the utilitymen what it is like to be both a customer and a competitor of TVA. Referring to the Electric Companies Advertising Program (ECAP), Pahle said: "Quit this cry baby advertising. Instead, use your ads to help bring up your annual kilowatt-hour consumption to the level in the (Tennessee) Valley; do it with good service, and you won't have to worry about whether your customers like you . . . they certainly will."

In a panel entitled "The Fourth Estate Views the Electric Industry," four editors told the PR men how utility operations looked from the newsman's point of view.

Lou Donnelly of the Journal of Commerce tweaked several utilitymen on their financial public relations activities, telling them to free themselves of the "deadening hand of the lawyers, who insist on keeping secret what everyone already knows."

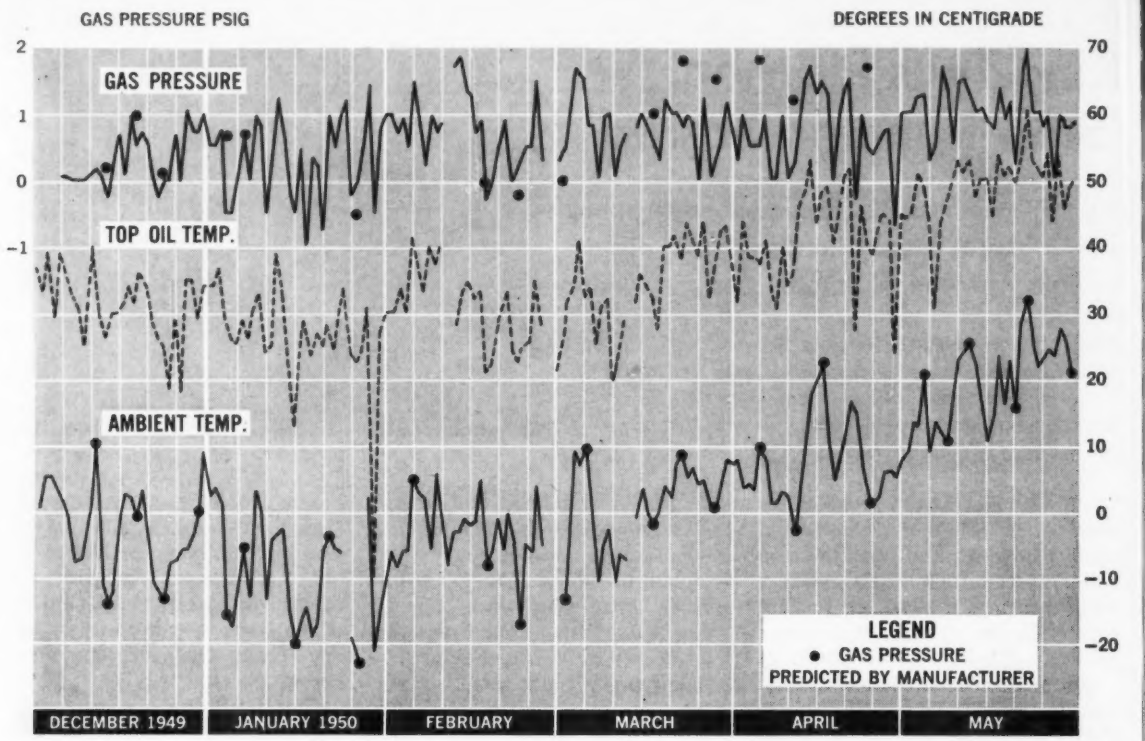
Paul C. Beatty, an editor of the Clarksville, Va., Times, gave the small-town newspaper editor's viewpoint. He feels the utility should pay more attention to everyday considerations, such as tree trimming.

A. N. Wechsler, Washington bureau chief of Conover-Mast, told the utilities to do more spadework with their general reporters "before you get in trouble." "You can't expect the reporter, who may be working on a bevy of other subjects, to give you the time and attention after the story breaks."

Gene Smith of The New York Times covered what he called "the fundamentals," such as knowing New York deadlines and allowing for the time lag in getting West Coast stories to meet them, and the use of pictures.

Herb Frankel of Electrical World outlined the business papers' need for more detailed information. Frankel also called for a national spokesman for the industry, one who can answer political charges immediately, "without checking with every utility executive from Maine to southern California."

E. M. Naughton, president, Utah Power & Light Co, and past president of PIP, received its Public Relations Achievement award. Other award recipients were Elmer Smith of Pennsylvania Power & Light Co, and Schuyler Baldwin of Rochester Gas & Electric Co.



PRESSURE AND TEMPERATURE CURVES are shown for the sealed-type transformers installed in 1949 and 1950

Sealed-Type Transformers Perform

G. R. DEINEMA, Maintenance Engineer, Northern States Power Co, Minneapolis, Minn.

Sealed-type power transformers with welded covers have been operated very successfully by Northern States Power Co for ten years. Two were installed in June 1949 as a step-up bank for a 70-Mw generator, and two for similar service to another generator in June 1950.

They are 3-phase, 37,500/50,000-kva, 108,900-13,690-v units.

These oil-insulated, self-cooled/forced-air cooled transformers have vertical expansion tanks for more gas space and a toggle manhole relief device for protection against abnormal pressure. Tank covers are welded, only the bushings and manhole covers having gaskets. Operating experience shows:

1. The transformers needed no maintenance.

2. There have been no fire hazards due to oil leaks.

3. They have never operated as free-breathing transformers.

4. Internal gas pressures remained well within ASA limits (not over 10 psig positive or 8 psig negative). Gas pressure can be predicted closely for given conditions.

5. It appears that when the units are properly designed, gas pressure can be kept below 3 lb, the point at which gas bubbles form. When forced oil pumps are left out, gas bubble formation is further reduced.

6. Power factor tests on windings and analysis of the oil indicate that all four are in very good condition despite the fact that the oil does not contain oxidation inhibitor.

7. Welded covers are needed to stop leaks regardless of the type of oil preservation used. The sealed-type system with welded covers appears to be the most simplified, and hence the most economical.

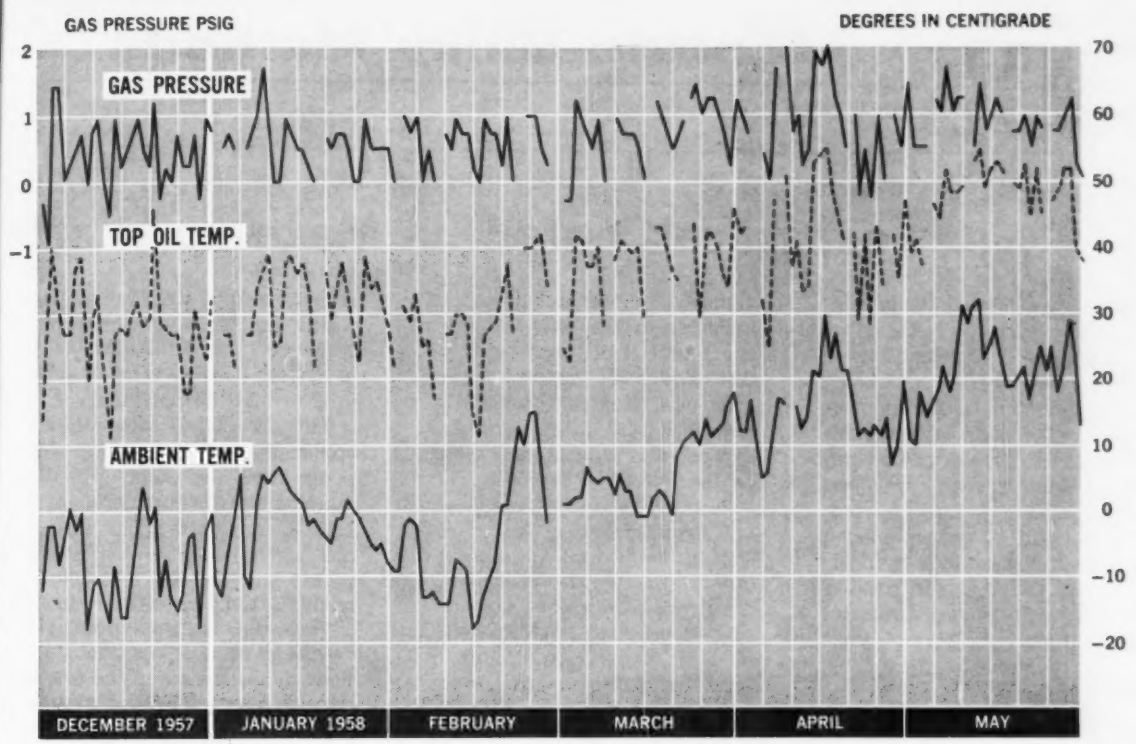
Since the banks were installed, station operators have recorded the daily 2:00 pm ambient and the top oil temperatures, and the gas pressure of each bank. Hot-spot temperatures are taken on graphic charts, and ammeter and kilowatt meter readings are recorded every half hour.

After operation of the first bank for a year, the manufacturer requested a copy of the daily gas pressure and the ambient and oil temperature readings. There was a direct variation of ambient and top oil temperatures, the gas-pressure range remaining rather constant.

During summer's higher temperatures, oil volume increased but gas volume decreased. More gas is then absorbed by the oil, and there is no increase in gas pressure. Actual gas pressure in the first year ranged from −1.0 to +3.75 psig. Had readings been taken in the early morning, the negative ones would have been slightly lower.

Neither additional gas nor maintenance work, such as checks for gas leaks, has been required. Recent gas-pressure readings ranged from −1.8 to +4.0 psig, about the same as at installation.

These four are the system's only large, sealed-type power transformers. Formerly such units were 2,500



Pressures last winter stayed within ASA standards, and ambient and oil temperatures varied directly

Excellently

kva and smaller. Other system power transformers are the conservator, gas-oil sealed, and automatic gas-sealed types, mostly with bolted covers. Their characteristics are generally known. The performance of the sealed-type transformers with welded covers in maintaining good seals, however, prompts a look at the performance of all types.

Conservator-type transformers in service several years often develop oil leaks in the tank cover gasket. Gasket material shrinks, losing its resiliency. Tightening the cover bolts stops leakage temporarily. Although oil leaks develop also in the bushing, manhole cover, and relief pipe gaskets, they are easy to repair. Repair of gaskets takes an extended transformer outage and is costly.

A leak in the relief diaphragm allows the transformer to breathe to the atmosphere, and condensation on the inside of the relief pipe causes formation of rust scales which could lead to failure. Although recent developments have improved the conservator-type transformer, with the bolted-type construction of the top covers, oil leaks still develop. Welded construction eliminates it.

Many gas-oil seal and automatic gas-seal-type transformers on the NSP system have developed gas leaks. When this happens, the transformer's operation as a free-breathing unit is detrimental.

Recently, the NSP construction department resorted to bolted-cover construction and a recessed gasket when a 15,000/20,000/25,000-kva unit failed to build up pressure because of gasket leaks. Tightening the cover bolts obtained metal-to-metal contact. The manufacturer then recommended that the cover be welded and furnished steel plugs to fill the bolt holes. A good seal has been maintained since the welding.

Insufficient gas-expansion space for the area's temperature range brought some difficulties with gas-oil seal transformers. Gas was forced out in the summer, and air drawn in in winter. The inhaling of air is most likely when transformers are taken out of service in cold weather, a considerable change in oil temperatures being thus created. Repair of leaks and routine addition of gas are costly in the conservator-type, the gas-oil sealed, and the automatic gas-sealed transformers.

NSP's former objections to sealed-type transformers were based on the high positive and negative pressures obtainable. During negative pressures moisture might be drawn into the transformer. But pressures experienced stayed well within ASA standards, and it appears that the designers can predict quite accurately the pressures that will be experienced for given operating and maintenance conditions. Tests indicate that moisture did not enter the transformers.

Some failures of sealed-type transformers in the recent past were attributed to gas-bubble formation in the oil. But tests show that bubble formation is negligible when internal gas pressure is held below 3 lb and the oil is not agitated.

Recent power factor tests on the windings showed:

CH	0.41 to 0.58%
C_6	0.31 to 0.48%
C_{HL}	0.25 to 0.43%

Analysis of insulating oil showed:

Interfacial tension	28.0 to 36.0
Neutral number	0.01 to 0.04
Specific gravity	0.881 to 0.889
Power factor	0.17 to 0.49%

Test Silica Content in Make-up Water

Silica concentration in demineralizer make-up water is being analyzed at St. Clair Power Plant of Detroit Edison Co with an automatic analyzer that measures concentration of trace materials down to parts per billion. Use of automation in this phase of power plant chemistry eliminates the tedious task of making frequent repetitive tests by manual means. The analyzer handles detailed colorimetric analyses that required eight separate steps by conventional "test-tube" means of testing.

Purchased for use with a new demineralizer unit recently installed at the power plant, the unattended analyzer continuously samples make-up water, detects tiny traces of silica, and accurately indicates silica concentration. This information shows the condition of the resin in the demineralizer anion exchangers and indicates to the operator when anion exchangers need regeneration. Following several weeks of trials by Detroit Edison, the analyzer was proved highly satisfactory and was assigned to full duty on the line.

Basically, the analyzer's pump unit handles and measures the samples and reagents in a continuously flowing stream. The characteristic blue color indicating silica concentration is developed in the stream. Color intensity is measured in a flow-type colorimeter, and its value is plotted continuously on a strip-chart recorder.

The proportioning pump can handle as many as eight reagents simultaneously. Peristaltic pumping action is performed by compressing plastic tubes against a platen with rollers. Pumping rates are governed by size of the tubes, which are available with inside diameters from 0.030 to 0.110 in., giving delivery rates of from 0.32 to 3.50 ml per min.

For the silica concentration application, the proportioning pump feeds the make-up water sample and hydrochloric acid into a horizontal glass mixing coil simultaneously. Air is admitted into the coil to facilitate mixing of the sample and reagent.

Next, the ammonium molybdate reagent is pumped into the flow. The stream then passes through a second horizontal mixing coil and into a long vertical coil to provide time for reaction. As the stream leaves the reaction coil, an amino acid reducing solution is pumped into the flow. Following addition of the reducing agent, the stream enters another mixing coil and then goes

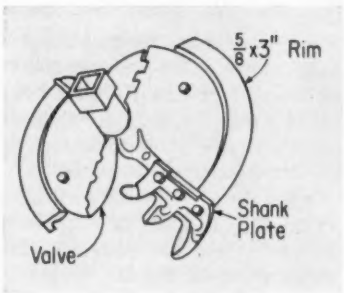
Expand Auger for Larger Holes

***ROY GASKILL**, Hole Digging Foreman, Kansas Gas & Electric Co, El Dorado, Kan.*

When Kansas Gas & Electric Co crews had to set poles too large for the holes dug by the auger on the hole digger, they modified the auger so that it could be used to dig larger holes. The auger extension will dig dirt or hardpan without difficulty and will dig rock after it has been blasted.

The largest auger available was 24 in. There was no 30-in. auger within reasonable distance that would dig rock. The poles to be set were 20 in. across at the butt.

The auger was modified by moving the shank plate, or tooth holder, out one hole. A rim made of 5/8x3-in. plate was attached to the outside hole of the shank plate. It was anchored to the body of the auger to support the



outside end of the shank plate and to carry out loose dirt. Cost of the rims made at a local machine shop was $18.

Rubber Blankets Protect Work Areas

Old and defective rubber blankets, those that have generally been discarded, are being used in Kansas Gas & Electric Co's meter department to cover work benches, test benches and shelves. The blankets are glued to the wood or metal tops in the same way that linoleum is applied over a surface. The rubber blankets make very fine and inexpensive work surfaces.

Automatically

into a second vertical coil.

Color is developed in the last vertical reaction coil. The stream finally flows through the photoelectric colorimeter and then to waste. Color intensity is recorded on the instrument chart as percent light transmission. The instrument chart reading is converted to parts per billion of silica.

Modular construction of the various analyzer units — sampling, metering, mixing, reaction, and analysis—permits flexibility in arrangement for plant or laboratory use. The analyzer does not require a technical specialist for its setting up or operation. Neither preparation of samples nor maintenance are required. In addition, the system is completely self-cleaning. The AutoAnalyzer is made by Technicon Controls, Inc.

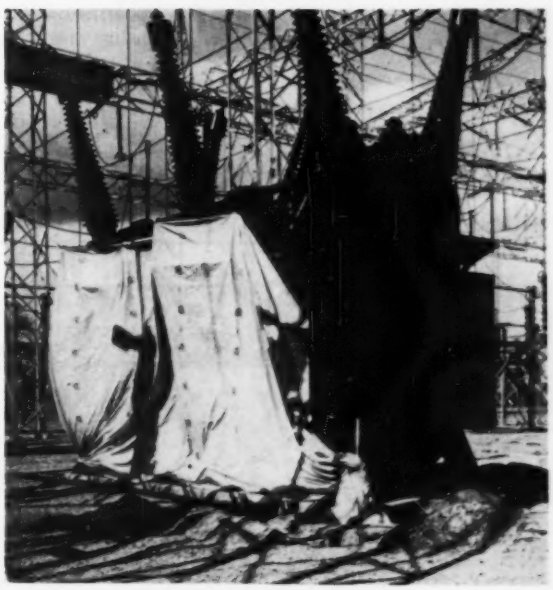
Nylon Tarpaulin Reduces Fire Hazards

Vinyl-coated nylon tarpaulin fabric has proven successful in reducing fire hazards during construction while contributing to safer working conditions. The material was used as a covering in a number of applications by American Electric Power system at the sites of two generating stations. In areas where the coverings were used at the stations, no fires were reported.

The fabric, known as Herculite 20, has a high tear strength, weighs 10 oz per sq yd, and will transmit daylight. At the Breed Plant the nylon tarpaulins were used by AEP's contractors as shelters during the assembly of 345-kv oil circuit breakers. Tarpaulin roofs also were put up over pulverizing pits while workmen installed cork linings.

In another instance, the covers were used during the winter while applying internal coatings of epoxy resin to condensers. With temperatures as low as 10F, the fabric did not stiffen or crack.

The bright yellow fabric was imprinted with the words "POWER COMPANY PROPERTY." After 36 months, the covers have remained bright. The fabric is made by Herculite Protective Fabrics.



Capacitors Are Today's Best Buy

Greater use of capacitors today, when prices make them the most economical source of reactive current, can save the utility industry money in investment and operating costs

W. G. HART, Capacitor Dept, General Electric Co Hudson Falls, N. Y.

Capacitor prices are now about 25% below what they were just two years ago. Utilities that have not reviewed the economics of kilovar supply on their systems in the two years will want to take another look. Such a review will most likely show that the cost of delivering energy to consumers today is lowest when enough capacitors are installed in the distribution area to keep substation power factor close to unity.

Capacitor kilovars today cost about the same as kvar capability purchased in a modern generator at 0.80 pf. But kvar from the generator must be transported over the transmission, subtransmission, and distribution systems to the point of use. This takes an investment in system components that must be factored into any comparison of cost.

Reactive Flow a Burden

From the thermal loading and loss standpoint, reactive power flow puts an increasing burden on the system for each additional kvar transported. For instance, when the generator must furnish 20 kvar with each 100 kw, the thermal load on the generator and system is 102 kva. Doubling the kvar and calling on the generator to supply 40 kvar with each 100 kw results in a 107.6-kva load. If 60 kvar are required, the load would be 124 kva.

Thus, the first 20 kvar adds 2 kva of load, the second 20 adds 5.6 kva, and the third 20 an additional 16.4 kva.

As system losses are proportional to kva squared, the rate at which each kvar transported adds to system losses is even greater. Cost of transmitting kilovars increases with each additional kvar.

At today's capacitor prices reduced losses, which used to be considered a bonus benefit, are a compelling reason for applying capacitors.

One large western utility reports that the effect of kvar flow on its energy and peak-load losses makes it economical to furnish only 25 kvar per 100 kva from the generator. The company's objective is a 0.97 pf at the generator at peak load and a 0.99 pf at the substation. System loss studies reveal that fuel cost savings, which are only 2.5 mills per kwhr for this utility, will equal the carrying charge on the last ckva added to raise substation power factor to 0.95. Deferred investment due to reduction in peak load makes the 99% pf most economical.

Many systems are voltage-limited rather than current-limited, making voltage benefit the compelling reason for installing shunt capacitors. Moreover, on most utility systems, kvar flow is responsible for a significant portion of the voltage drop.

Engineer studies show that system loading can be increased 1 kw for each ckva installed in the load area without exceeding the original voltage drop.

Capacitors Defer Investment

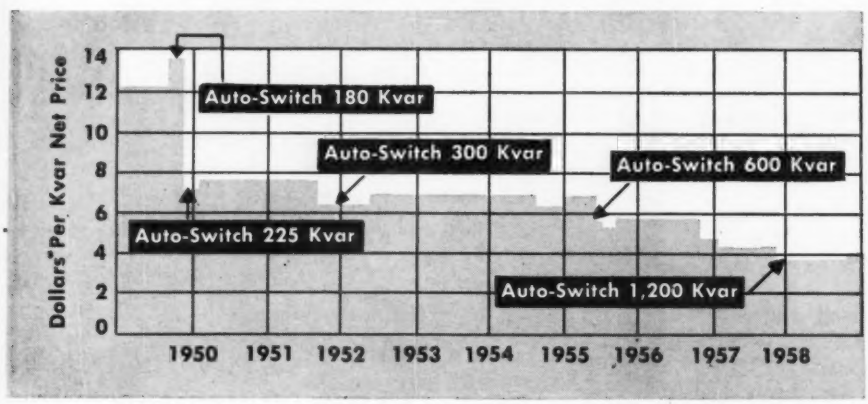
Accordingly, 1 ckva costing $5 to $6 installed allows an additional kw of load to be served and defers an investment of $30 or more. This one-for-one relationship for loading and voltage drop pertains even when ckva in the load area exceed requirements and kvar flow back toward the generator. Often it is economical to use more capacitors than the load requires at a given time, on voltage-limited systems.

A large Eastern utility reports finding it uneconomical to furnish generated kvar to the distribution area. Its load is concentrated and the company does not transmit power over long distances. It is primarily concerned with voltage. Optimum system operation is being achieved by installing enough capacitors on distribution feeders to maintain power factor slightly leading or lagging at time of peak.

The trend to higher-rated capacitor banks, along with the reduction in capacitor unit prices, have cut the installed cost per kvar of switched pole-top equipments about 50% since 1950. Higher rated equipments, made possible by the development of capacitors that are lighter and smaller for their rating, have reduced switching and control requirements per kvar.

Now, more than ever, capacitors are the most economical source of kilovars. As a result the utility industry can save money, both in system investment and in operating costs, by using more capacitors.

KILOVAR COST of switcher capacitors assemblies for pole mounting is half what it was ten years ago. Size of switched capacitor banks grew



A Special Report

DAN BRAYMER, Senior Editor

Modern steam power plants cost less to build and produced electrical energy at a lower cost in 1958 than in 1956. Although the fuel they burned cost more, the use of higher steam pressures and temperatures, use of reheat, and installation of larger units pushed heat rates down significantly. As a consequence fuel's contribution to the production cost of energy was well in line with previous years.

Highlights of the current survey are tabulated below and compared with previous reports. Because they are unweighted averages, caution should be used in drawing specific conclusions without careful study of the detailed data.

Cost and performance data, presented in this report covers 55 new power plant installations. Included is data on completely new stations not previously reported, that were in operation in 1958. Also included is data on older plants, put in service in 1950 or later, to which new extensions have been added. In these instances data is for the complete plant.

11th Steam Station Cost Survey

	11th Survey	10th Survey	9th Survey
For plants operating in...	1958	1956	1954
Average Busbar Energy Costs (mills per net kwhr)	7.04	7.15	6.30
Average Construction Costs-excluding swyd (dollars per kw)	140.60	146	131
Average Production Costs (mills per net kwhr)	3.72	3.25	3.10
Fuel Costs, portion of production costs (in percent)	80.8	83.0	83.0
Average Annual Plant Factor (in percent)	61.8	69.0	71.6
Average Utilization Factor (in percent)	100.4	103.0	106.4
Predominant Steam Cycles (steam pressures and temperatures)	1,800 psi 1,000F/1,000F	1,800 psi 1,000F/1,000F	1,800 psi 1,000F/1,000F
Use of Reheat (percent of total capability reported)	70.0	80.0	55.0
Manpower Requirements (operating & maintenance employee per Mw)	0.37	0.37	0.50
Auxiliary Power Requirements (percent of gross generation)	6.0	6.0	6.0

Busbar Energy Costs Dip Slightly

Average drops from 7.15 mills to 7.04 mills per net kwhr since 1959. Carrying charges vary over 9 to 1 range. Percentage used for annual carrying charge ranges up to 18%

New steam power plants produced energy in 1958 at an average cost of almost exactly 7 mills per net kwhr. Between 1954 (EW, Ninth Steam Station Cost Survey, Oct. 17, 1955) and 1956 (EW, Tenth Steam Station Cost Survey, Oct. 6, 1955) average energy cost at the busbar rose from 6.3 to 7.15 mills. The present survey records a small but nonetheless notable decline in average energy cost to 7.04 mills per net kwhr since 1956.

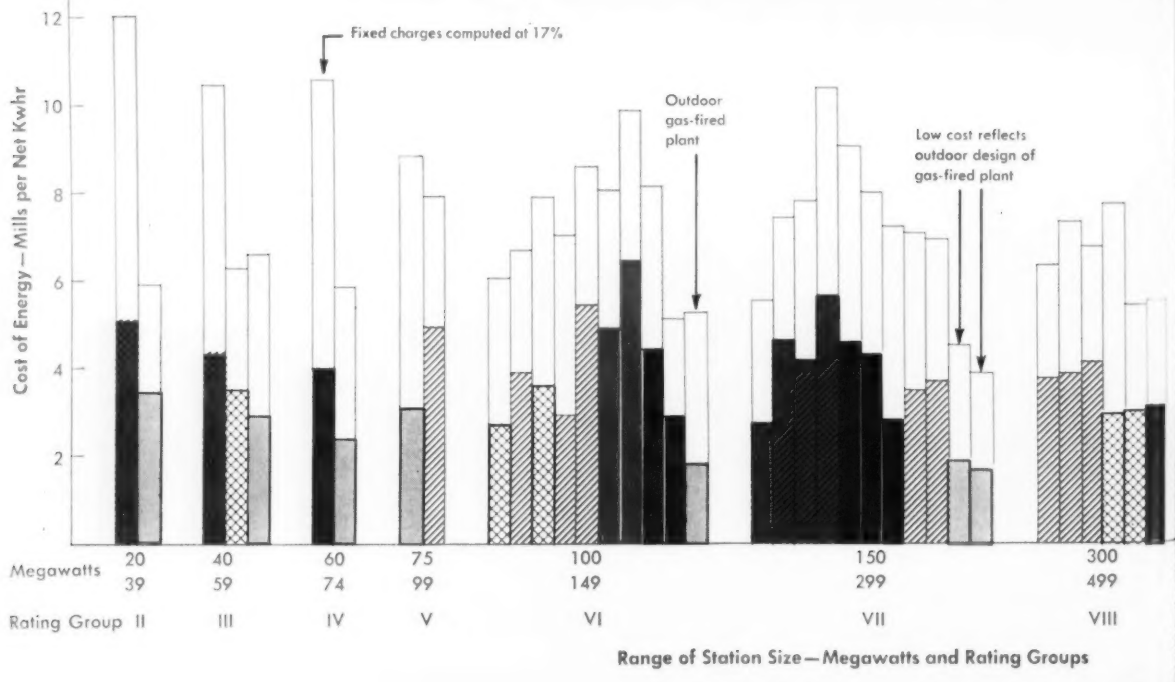
Individual plants produced energy at costs that ranged all the way from a minimum of 3 mills to a maximum of 12 mills per net kwhr. At both extremes fixed charges were the dominant factor. Two stations produced energy at the 3-mill level. In both stations fixed charges were less than ¾ mill, reflecting charges for depreciation only. At the other extreme, the station with the highest energy cost, 12 mills, had carrying charges of 7 mills. The range of fixed charges from least to greatest is more than 9-to-1.

Analysis shows that 81% of the reporting stations had energy costs at the busbar of 8 mills per net kwhr or less, (in 1956 this percentage was 63%); 55%, 7 mills or less; and, 31%, 6 mills or less per net kwhr.

Very little difference in total energy cost was apparent between entirely new stations (which averaged 7.05 mills per net kwhr) and older stations to which recent additions had been made. Total energy cost for the latter averaged 7.02 mills per net kwhr. On the other hand, it was apparent that station size has an influence on energy cost at the busbar. Stations with 150-Mw or more capacity averaged 6.5 mills, but smaller stations report an average energy cost of 7.5 mills per net kwhr.

Investment charges and fuel cost, along with plant factor, exerted the greatest leverage on the cost of energy produced by reporting stations. The 9-to-1 swing in investment charges, already noted, contrasts sharply with the relatively moderate 3-to-1 range of the production cost component. This fact clearly reflects the wide divergence in the percentage used in computing investment charges for individual stations. This percentage ranged from a low of 2.8% for a public power agency to a high of 18.16% used by a private power company. The average percentage for all reporting stations was 13%. This value is deceiving, however, because of the extremes cited. A more precise picture of the practice is found in the fact that 67% of stations reporting computed carrying charges at more than 13%;

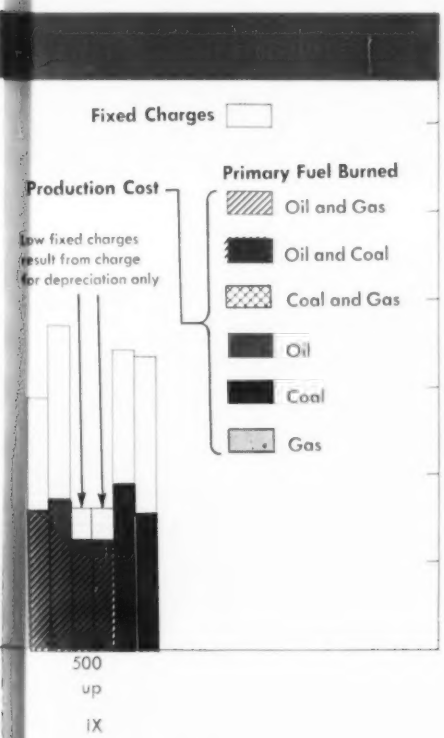
Total Cost of Energy at the Busbar for Modern Steam Stations

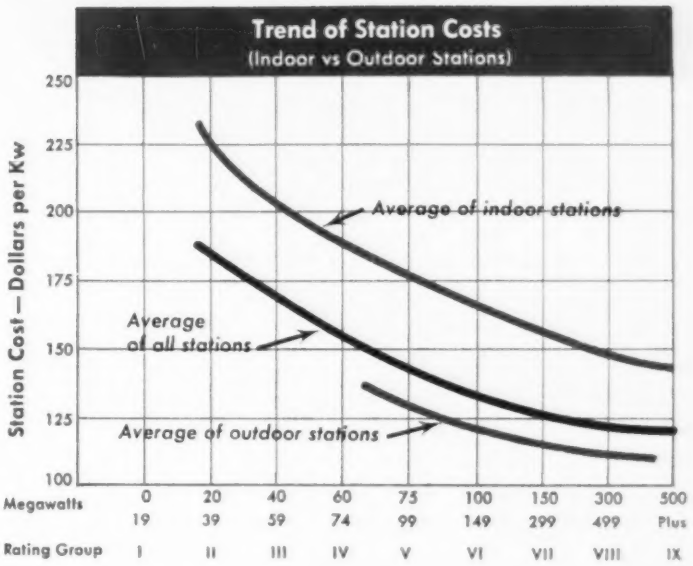


25% of them at 15% or more, and only 33% at 13% or less.

Fuel costs averaged 42% of the total cost of energy produced by individual steam stations responding to the questionnaire. Classification of returns by type of fuels burned in individual stations showed the highest average energy cost per net kwhr is associated with burning oil. For oil-fired plants energy costs averaged 8.9 mills per net kwhr. Plants burning oil and gas are next with 7.5 mills and coal-fired plants a close third at 7.4 mills per net kwhr. The rest in decreasing order are; coal and oil 7.26 mills, coal and gas 6.6 mills, and gas 5.8 mills.

Operating costs are about equal to fixed charges when an average is taken for all reporting stations. The ratio of average production cost to average investment charge is 1.12 to 1. Closer study shows, however, that for 19 of the 42 stations for which energy costs are charted, fixed charges actually exceeded operating costs. The ratios range up to 1.4 to 1. The average of all fixed charges was 3.32 mills, and the average of all production charges 3.72 mills per net kwhr.



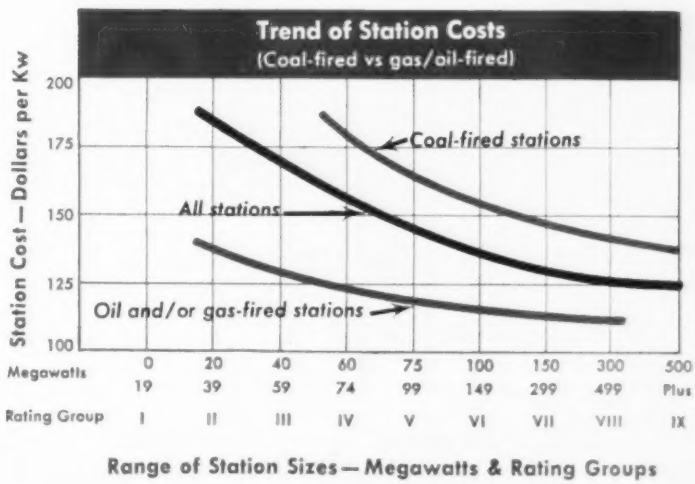


Range of Station Sizes — Megawatts & Rating Groups

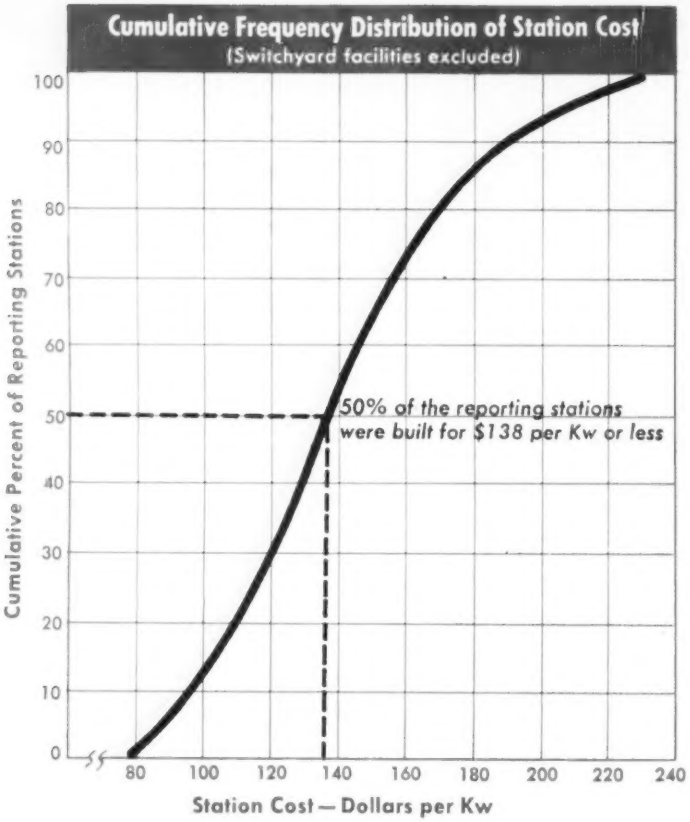
Station Cost Drops 4%

Average stations costs $141 per kw, $5 less than in 1956. Outdoor plants cost $30 to $45 less per kw than indoor

There has been a significant drop in the cost of building steam power plants since the 10th Steam Station Cost Survey (EW Oct. 7, 1957). The present survey results show that the average station, operating in 1958, cost $140.60 per kw, exclusive of switchyard facilities. The previous survey of stations operating in 1956 showed average station cost as $146. Thus there is a decrease of more than 4% in station building cost since 1956. This is a surprising fact in the face of the upward movement of construction cost indices over the period. If nothing else it points the danger of generalization



Range of Station Sizes — Megawatts & Rating Groups



from averages encompassing broad station groupings. The fact remains that average station building cost is up $10 per kw from the $131 average of 1954.

Cost of individual reporting stations range from a low of $87 per kw for a gas-fired outdoor station in the South Central region to a high of $230 per kw for a small single-unit, coal-fired, indoor station in the Rocky Mountain region. A distribution curve of station costs shows that half the 55 stations reporting were built for less than $138 per kw. In 1956 this median was $136 per kw.

Slightly more than 25% of the reporting stations were totally outdoor type, having unenclosed boilers, turbines, fans, and, in several instances, condensers out of doors. These stations were built for an average cost of $117 per kw compared to $154 for indoor stations. For gas and/or oil-fired stations the average cost was $122.21 vs $157 for coal-fired plants.

It was not unexpected that outdoor gas-fired stations would report the lowest cost. They are almost exactly the same stations that make up the group of outdoor plants for which average cost has been given as $117 per kw. It should be observed, however, that outdoor station construction was confined mainly to stations in the size range from 75 to 500 Mw. Indoor construction was more prevalent in stations outside this range. The differential in cost between outdoor and indoor stations ranged from $47 to $31 per kw.

Little if any significant change is apparent in the pattern of station cost distribution. Boiler equipment still takes the lion's share of the plant construction dollar; 36.4% for gas or oil-fired plants. 40.6% for coal-fired plants. This compares with 37.8 and 40.2% in 1956. The turbine-generator takes 38.3% and 28.3%, structures 15.3% and 21.3%, accessory electrical equipment 8.5% and 7.6%, miscellaneous equipment 1.5 and 2.2%, for these types of fuel.

Production

Fuel, labor costs rise over 1956 levels. Average production cost is 3.72 mills per net kwhr, up almost 15%

Average production costs continued to climb in 1958, and somewhat faster than in 1956. Production costs are up 14.5% above those reported in the 10th survey. These were in turn up 5% from comparable figures for 1954. Costs averaged 3.72 mills per net kwhr. Fuel, as usual, accounted for the greatest share of this cost. This is the way the average production costs divided:

Fuel	80.8
Labor	10.4
Maintenance	6.6
Water, lubrication, supplies	2.2
	100.0%

Plant factor was taken into account when developing the trend of production costs as a function of station size. The curve at right shows the extent to which plant factor influences production costs. As expected, the larger the station and the heavier it is loaded the less will be the unit cost of production.

Plant Heat

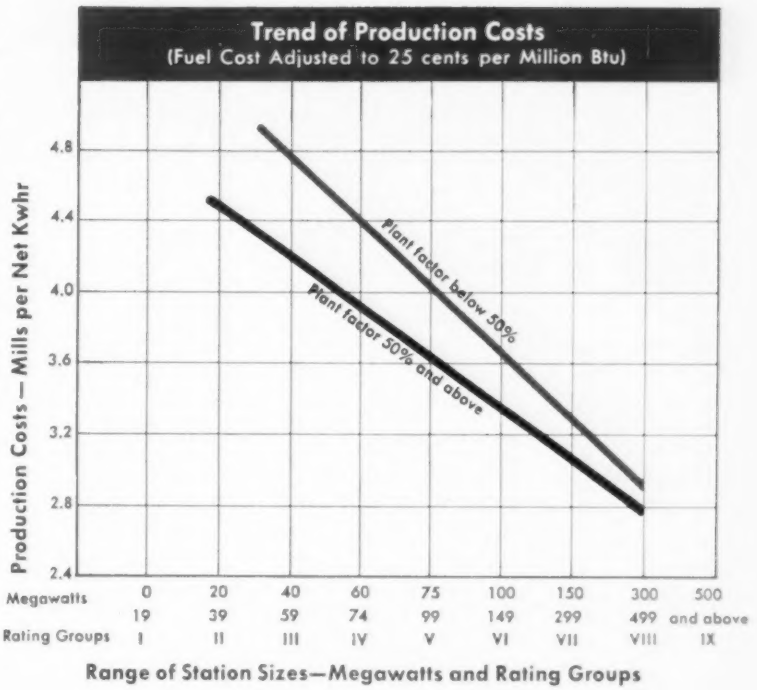
Heat rates for both small and very large stations improve over 1956. Average gas price up 30% since 1956

The trend of station heat rate, shown in the accompanying chart, reflects notable improvement since the previous survey. Small-plant heat rates, as well as large, are improved. In the 20-to-39 Mw range, they are about 13% lower than in 1956. Heat rates for plants 500 Mw and larger are about 6% lower.

Costs Continue to Climb

Fuel costs were adjusted to a common base of 25 cents per million Btu (average fuel cost for all plants was 27.4 cents) for the curves to cancel out the effect of favorable plant location on the trend curves.

Plant factor, while having an effect on labor costs, showed less of an effect than it had on overall production costs. Unit labor cost seemed to be affected by station size only. Average unit labor costs were 0.39 mills per net kwhr, but costs for plants of the order of 100 Mw and below were almost double —0.70 mills. Labor costs for large plants, 300 Mw and above, averaged about 0.22 mills per kwhr.


Trend of Production Costs
(Fuel Cost Adjusted to 25 cents per Million Btu)
Production Costs — Mills per Net Kwhr
4.8
4.4
4.0
3.6
3.2
2.8
2.4
Plant factor below 50%
Plant factor 50% and above
Megawatts
0 20 40 60 75 100 150 300 500
19 39 59 74 99 149 299 499 and above
Rating Groups
I II III IV V VI VII VIII IX
Range of Station Sizes—Megawatts and Rating Groups

All Costs Increase

All of these costs showed increases above those prevailing in previous surveys. Average unit labor costs in 1956 were 0.35 mills per net kwhr. Small plant labor costs were 0.63 mills, and large plants costs were 0.2 mills per net kwhr.

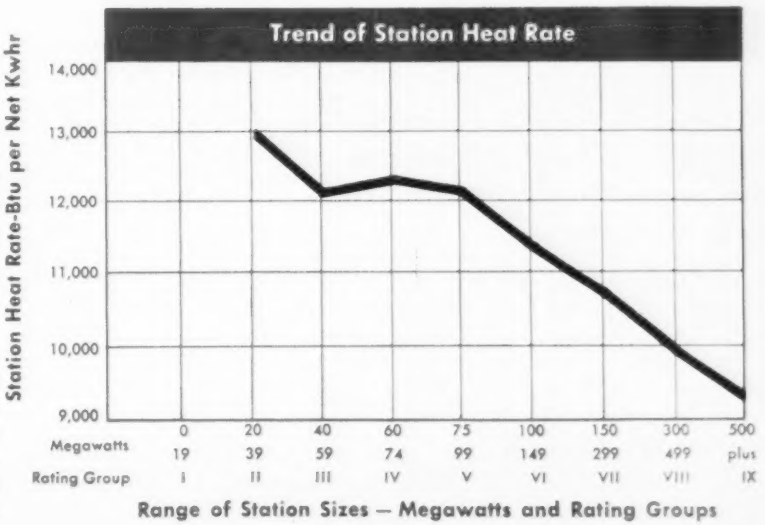
The boiler again claimed the largest single part of the maintenance dollar. Expenditures for this type of maintenance averaged about 0.082 mills per net kwhr, up 0.019 mills from the previous survey. Similar expenses for the prime mover and its auxiliaries were 0.062 mills and 0.027 mills for the fuel handling equipment. The latter figure was below the 0.043 mills reported on the 10th survey and is undoubtedly due to the greater number of natural gas and oil burning plants on the present survey.

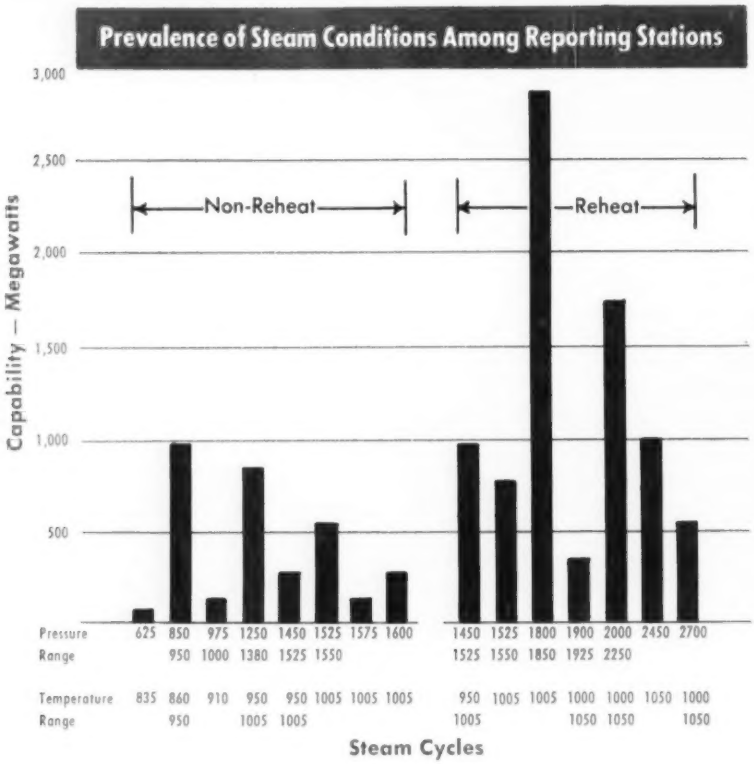
Prime mover expenses jumped 0.015 mills from the levels of the 1956, an increase of 32%. In the previous survey, boiler maintenance expenses were 33% greater than prime mover expenses, and this trend ratio is observed in this survey as well.

Rates Better

Heat rates of individual plants ranged from 15,050 Btu per net kwhr for a 75-Mw, low-pressure plant with no reheat, to 9,160 Btu per net kwhr for an 800-Mw plant using steam at 2,400 psi 1,050/1,000F in a 300-Mw unit. Average heat rate for all reporting stations was 10,934 Btu per net kwhr.

Clearly the improved heat rate in smaller-size plants stems from the upward movement of pressures and temperatures and reflects the use of reheat in units as small as 50 Mw. In the 500-Mw-plus range of station size, lower heat rates can be attrib-


Trend of Station Heat Rate
Station Heat Rate-Btu per Net Kwhr
14,000
13,000
12,000
11,000
10,000
9,000
Megawatts
0 20 40 60 75 100 150 300 500
19 39 59 74 99 149 299 499 plus
Rating Group
I II III IV V VI VII VIII IX
Range of Station Sizes — Megawatts and Rating Groups



These circumstances also have a significant bearing on the drop that took place in the ratio of peak demand to capability (utilization factor). The average utilization factor for reporting stations was 100.4%, off 2.6 percentage points from the 1956 level of 103% and a full 6 percentage points under the 1954 average. Only five stations recorded utilization factors of 110% or more compared with eight in 1956.

The average of all fuel costs for reporting stations was 27.6¢ per million Btu. Gas prices jumped from an average of 21.3¢ per million Btu in 1956, to 27.7¢ per million Btu in 1958, an increase of 30%. Average price of coal quoted by reporting stations was 29¢ and oil 56¢ per million Btu. It should be noted that these prices are unweighted averages however.

Fuel costs in New England continued to top those in other regions. Fuel costs there averaged 36.7¢ per million Btu. Lowest fuel cost was in the West South Central area, where it averaged 13.0¢ per million Btu.

Predominance of reheat steam cycles marks this survey, as it did the last. Of capacity reported, 70% use reheat. Stations using reheat cycles with steam conditions of 1,800 to 1,850 psi and 1,005 Superheat accounted for more than one third the 8,500 Mw of reheat capacity reported. Of the survey's 55 stations, 35 had one or more reheat units in operation.

uted to the improved efficiency that comes with units in the 250 to 300-Mw range of which several are represented in the survey returns.

Ratio of average annual plant load to capability of all units (plant factor) was 61.8% for 1958. It was down 7½ percentage points compared with 1956. The decline parallels the sharp upturn in the industry's gross margin and generating capability that took place between 1956 and 1958. (EW Sept 14, 1959 p 112) and reflects lighter loading of the industry's facilities during a recession period.

More Plant Equipment Put Outdoors

More plants putting fans, boilers, turbines, and condensers outdoors than in previous surveys. Boiler and turbine room cubature declines

The composite of station design features on the last page of the survey demonstrates the growing popularity in modern plants of shaft-driven exciters, outdoor fans, boilers and turbines, mechanical flyash collection, cooling towers and demineralizers. It also records a sharp drop (22 percentage points) in the number of stations reporting use of gas recirculation. There were 14 among the 55 stations participating. The previous survey reported 21 among 44 stations.

Outdoor boilers were used by 62% (34) of reporting stations, outdoor turbines in 27% (15), outdoor condensers in 20% (11) and outdoor fans in 80% (44). All four of these outdoor components were incorporated in 10 plants (18%) all located in the country's southern tier.

Although shaft-driven exciters are used in 78% (43) of reporting stations, 43.7% (24) report used motor-driven exciters. This is 11 percentage points higher than in 1956. Cooling towers and demineralizers are both used in 42% (23) of the plants.

Average boiler room cubature continues to edge downward with each survey. In this one it hovers around 11 cu ft per kw compared with 12 to 13 in 1956 and 1954; 15 cu ft per kw in 1952.

Turbine room cubature too appears to be declining in all but the smaller plants. The survey shows 6 to 7 cu ft per kw predominant against 7 to 8 in 1956.

The amount of coal kept in storage appears to have stabilized at around 1 ton per kw and has held this level over the past three surveys.

O & M Needs Dominate Plant Forces

Operating and maintenance forces comprise up to 80% of station personnel. In large plants the employee-supervisor ratio approaches 12:1

Little if any significant change has taken place in the pattern of manpower requirements for steam stations since 1956. The present survey shows that for stations operating in 1956, operating and maintenance personnel continued to make up from a little less than two-thirds, to about 80% of station forces, depending on size.

In the larger stations (150 Mw and above) operating and maintenance forces comprised from 60 to 70% of plant employes. In the medium station range (75 to 150 Mw) the average rose to around 75% and in small stations (20 to 75 Mw) operating and maintenance forces aggregated 80% of the total.

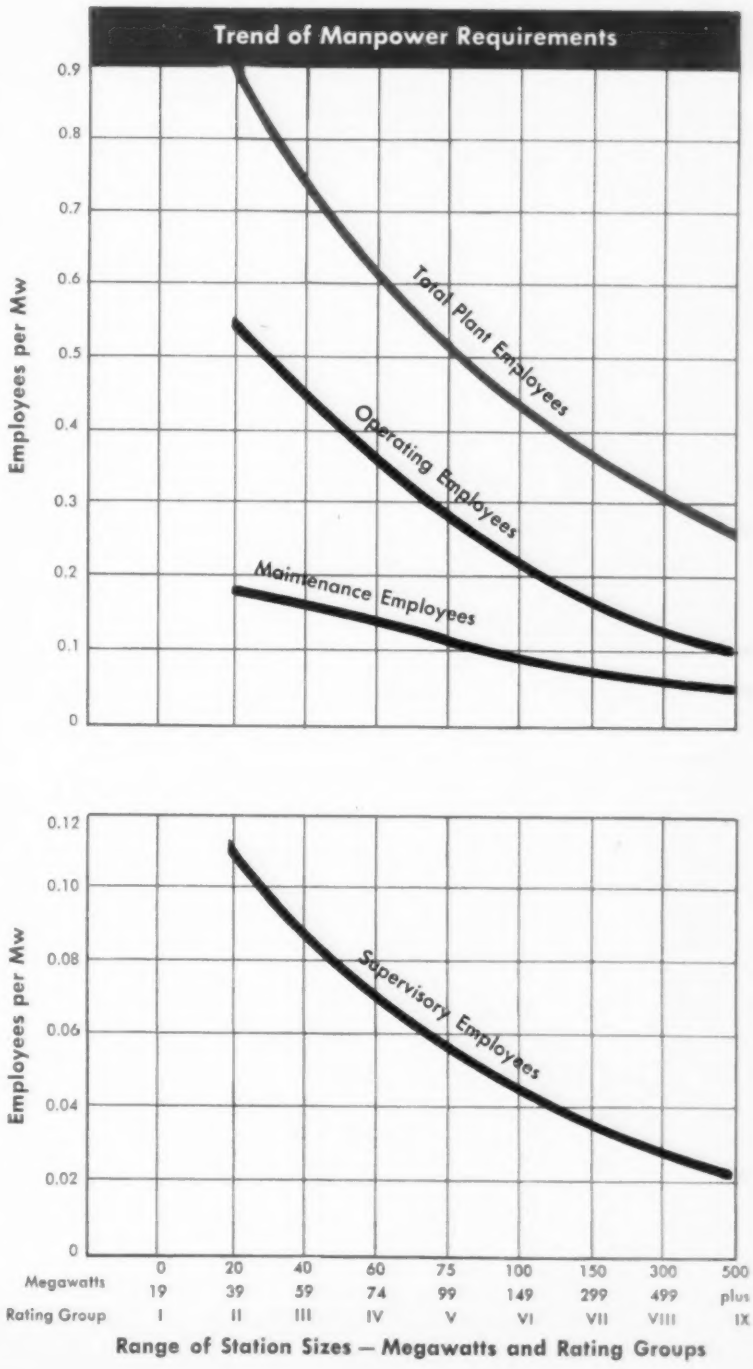
A plot of operating forces per Mw vs station size is definitely nonlinear and shows a tendency to flatten out in the region of larger plants. Above 150 Mw plant capacity the average is about 0.1 employee per Mw while in the middle range of station size, from 75 to 150 Mw, it is about 0.25. Operating forces top 0.5 employees per Mw in the 20 to 40 Mw plant size range.

Maintenance employees bear a more nearly linear inverse relationship to plant size, as is understandable. The variation in maintenance employees per Mw between the least and the largest plants is not great . . . something less than 2 to 1. For plants over 150 Mw maintenance workers number 0.075 per Mw, for those under 75 Mw in size it is 0.14.

Like the maintenance forces, fuel handling employees per Mw vary inversely with station size in linear fashion. About twice as many men are required per Mw in this work classification in small stations compared to large. For 300 Mw plants and larger the employee per Mw ratio is 0.028 for plants smaller than 60 Mw, about 0.05.

Supervisors work harder in bigger plants than in small, judging from the ratios. In plants of 500 Mw and larger there are 11.75 employees per supervisor on the average. But at the other extreme of plant size the employee per supervisor ratio is down to 6 to 1. In the middle range of station size it is virtually 8 to 1.

Station auxiliaries used about 6% of gross generating capacity. Most stations used somewhere between 4 and 7% of gross generation for station auxiliaries.



STATION NUMBERS†	332(304)	333(294)	334(241)	335(297)	336	337
GENERAL DATA						
Year, first operation	1956	1955	1953	1955	1953	19
newest unit	1958	1957	1956	1957	1957	19
Total generator rating (MMRC)*	IX	IX	IX	IX	IX	
No. of turbogenerators	3	4	4	3	4	
Range of unit ratings*	VII, VIII	VII	VI, VII	VII	VI	
No. of boilers	3	4	4	3	4	
Range of ratings (M lb/hr)	1,710–2,000	1,280	875 & 1,500	1,200 & 1,800	755 & 820	1,4
Steam pressure (psi)	2,050–2,450	1,846	1,850 & 2,400	1,900 & 2,100	1,750–2,250	2,0
Steam temp, initial supht (F)	1,050	1,053	1,050	1,050	1,000	1,0
reheat (F)	1,000	1,053	1,000 & 1,050	1,010 & 1,050	1,000	1,0
Cooling water range (F)	34–77	31–75	33–74	37–82	34–65	37–
Corresponding vacuum (in. Hg)	0.65–1.85	0.57–1.97	0.91–1.84	0.60–1.70	0.4–1.0	1.30–2
Plant site area (acres)	121	2,114	132	217	412	1,7
In use (acres)	121	68	132	65	161	
Fuel storage, coal (tons)	1,800,000	520,000	1,000,000	1,000,000	2,000,000	470,0
Oil (bbl)	125,000	895	286	.....	.....	1,7
Employees, total	146	296	150	179	197	2
Supervision	48	6	16	5	23	
Operation	47	104	56	104	81	
Maintenance	21	85	37	34	65	
Clerical, stores	11	26	5	9	10	
Fuel handling	14	32	12	16	11	
Guards, laborers	5	43	24	11	7	
OUTPUT DATA						
Total gross gen (kwhr x 10^6)	3,781	3,879	4,510	4,116	3,291	2,9
Total net gen (kwhr x 10^6)	3,592	3,682	4,233	3,845	3,123	2,8
Maximum 1-hr peak (Mw)	788	821	637	585	550	4
Hours operation 1958	8,760	8,759	8,760	8,760	8,760	8,6
FUEL CONSUMPTION						
Coal (tons)	1,287,727	1,335,412	1,654,463	1,714,841	1,203,000	1,163,4
Btu/lb	12,300	13,000	12,213	10,476	12,200	11,5
Ash (%), Moisture (%)	9.1, 7.2	8.9, 4.8	9.5, 7.8	11.5, 14.7	7.7, 8.7	10.6, 9
Cost (¢/million Btu)	31.2	20.35	28.22	28.56	32.26	18
Oil (bbl)	19,061	7,685	7,398	.....	.....	11,7
Btu/gal	151,842	134,890	136,695	.....	.....	135,4
Cost (¢/million Btu)	36.9	.....	85.29	.....	.....	118
Gas (M cu ft)	179,140	.....	.....	.....	.....	.....
Btu/cu ft	1,008	.....	.....	.....	.....	.....
Cost (¢/million Btu)	67.9	.....	.....	.....	.....	.....
OPERATING COSTS						
(Mills per net kwhr)						
Wages (incl supervision)	0.211	0.208	0.324	0.21	0.35	0.1
Water, lubrication, supplies	0.052	0.061	0.022	0.04	0.04	0.0
Maintenance	0.156	0.185	0.111	0.22	0.40	0.2
Total, oper & mtce (excl fuel)	0.419	0.454	0.457	0.47	0.79	0.3
Fuel	2.894	1.938	2.699	2.67	3.03	1.8
Total operation (incl fuel)	3.313	2.392	3.156	3.14	3.82	2.4
INVESTMENT DATA						
(Dollars per kw)						
**(310) Land	1.52	1.89	0.55	1.09	0.21	1
(311) Structure, improvements	28.28	24.48	23.83	34.96	34.88	29
(312) Boiler plant equipment	60.16	51.30	48.59	68.98	57.41	62
(314) Turbogenerator unit	37.48	37.69	29.42	41.11	37.74	35
(315) Accessory elec equipment	9.53	7.26	5.26	14.49	6.65	8
(316) Misc plant equipment	2.88	2.08	1.30	1.21	1.64	2
Total station	139.85	126.70	108.95	161.84	138.54	139
Outdoor switchyard	5.38	7.84	4.70	11.14	5.33	7
Total, station and switchyard	145.23	134.54	113.65	172.98	143.86	147
COST OF ENERGY						
(Mills per net kwhr)						
Fixed charges	4.132	0.739	2.551	3.62	3.12	0.7
Computed at (%)	12.61	2.813	14.18	13.31	13.55	2.8
Operating charges	3.313	2.392	3.156	3.14	3.82	2.4
Total	7.445	3.131	5.707	6.76	6.94	3.1
STATION PERFORMANCE 1958						
Billion Btu used	33,053	34,765	40,406	35,930	29,359	26,8
Fuel cost (¢/million Btu)	31.4	20.45	28.28	28.56	32.26	19
Btu/net kwhr send out	9,160	9,440	9,545	9,344	9,402	9,5
Btu/gross kwhr generated	8,740	8,960	8,960	8,730	8,921	9,0
Average boiler efficiency (%)	87.8	89.1	89.3	87.3	89.16	88
Station thermal eff, net (%)	37.3	36.2	35.8	39.1	36.3	35
Employees (Oper & Maint) per Mw	0.081	0.236	0.115	0.29	0.39	0.3
Plant factor, annual (%)	75.9	55.4	76.6	75.3	75.1	68
Utilization factor, annual (%)	93.6	102.6	101.0	100	110.0	99

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

** Electric plant account numbers prescribed by Federal Power Commission.

* Rating groups (Manufacturer's Maximum Rated Capability) Mw; I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

55 Modern Steam Stations

337	338	339	340	341	342	343(279)	344	345
	1958	1951	1954	1957	1957	1953	1956	1956
	1958	1958	1958	1957	1958	1957	1957	1958
	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII
	2	3	3	2	2	3	2	2
	VII	VI, VII	VI	VII	VII	V, VI	VII	VI, VII
	2	3	3	2	1	3	2	2
	1,560	780 & 1,160	853–950	1,160	1,200	775–1,050	1,254	1,000 & 1,260
	2,400	1,450 & 2,700	1,575–1,876	2,700	2,000	1,350–1,550	1,800	1,975 & 1,580
	1,050	950 & 1,050	1,000 & 1,005	1,050	1,000	955–1,005	1,000	1,005
	1,000	950 & 1,000	1,000 & 1,005	1,000	1,000	.....	1,000	1,005
	58–71	35–84	33–85	38–89	39–81	47–98	55–75	32–90
1.30–2	1.34–1.92	1.40–2.65	0.5–2.5	1.46–2.93	0.98–2.36	1.28–3.78	1.26–2.16	0.72–2.25
	53	55	393	.....	120	280	190	540
	53	55	252	160	94	280	.....	540
470,0	.....	210,000	222,000	650,000	360,000	.....	.....	150,000
	447,600	.....	.....	.....	357	60,000	280,000	.....
	46	80	150	77	66	81	53	63
	10	13	8	16	11	17	10	4
	21	22	79	25	22	35	21	22
	10	16	26	16	17	22	13	20
	3	5	3	5	5	2	3	3
	.....	8	15	10	7	.....	.....	8
	2	16	19	5	4	5	6	6
2,9	1,051	1,474	1,659	2,326	1,408	1,323	2,017	1,715
2,8	994	1,414	1,549	2,192	1,333	1,242	1,911	1,624	
	430	340	343	334	186	329	350	342
8,6	5,877	8,744	8,760	8,759	8,244	8,760	8,745	8,008
1,163,4	.....	292,870	630,956	778,806	225,411	.....	.....	582,441
11,9	.....	12,868	11,525	12,917	13,422	.....	.....	13,348
10.6,9	.....	8.9, 5.9	11.4, 8.5	8.6, 5.8	7.6, 4.6	.....	.....	6.5, 4.0
18	.....	29.92	20.34	30.64	34.5	.....	.....	30.2
11,7	923,550	.....	.....	.....	17,995	4,290	1,336,714	.....
135,4	150,103	.....	.....	.....	140,000	140,770	154,250	.....
116	42.7	.....	.....	.....	85.2	44.94	38.0	.....
	3,486,890	6,398,298	1,374,348	.....	495,143	12,947,274	9,171,233	.....
	1,033	1,056	1,040	.....	1,400	1,083	1,058	.....
	33.0	25.19	21.12	.....	18.2	7.9	32.3	.....
0	0.186	0.24	0.37	0.17	0.146	0.169	0.136	0.102
0	0.201	0.03	0.12	0.03	0.084	0.036	0.060	0.021
0	0.040	0.09	0.38	0.05	0.141	0.161	0.116	0.134
0.5	0.427	0.36	0.87	0.25	0.371	0.366	0.312	0.257
1	3.70	2.80	2.09	2.81	2.6	0.903	3.360	2.944
2.4	4.127	3.16	2.96	3.06	3.0	1.269	3.672	3.201
1	3.03	0.09	0.78	0.17	2.38	.....	2.15	0.24
29	10.98	16.57	26.53	21.20	27.26	11.99	9.42	3.22
62	45.07	37.90	44.76	45.22	69.21	34.10	48.94	49.26
35	48.42	30.02	33.48	30.79	39.89	36.80	36.85	38.78
8	8.20	6.51	13.71	6.57	7.18	5.59	9.89	4.46
2	1.68	1.00	0.93	1.48	1.90	0.64	1.92	1.19
139	117.38	95.43	120.19	105.43	147.82	89.12	109.17	97.15
7	5.48	.....	3.89	5.67	5.73	5.72	6.10	1.74
147	122.86	.....	124.08	111.10	153.55	94.84	115.27	98.89
0.7	2.55	.....	4.77	.....	2.33	.....	2.75	2.26
2.8	13.8	.....	16.0	.....	11.9	.....	13.9	12.5
2.4	4.13	3.16	2.96	3.06	3.0	1.269	3.67	3.20
3	6.70	.....	7.73	.....	5.33	.....	6.42	5.46
26,8	9,426	14,294	15,973	20,120	12,838	14,210	18,363	15,548
19	39.0	27.68	20.4	30.64	27.2	7.78	35.0	30.2
9,5	9,480	10,105	10,302	9,178	9,628	11,312	9,610	9,577
9,0	8,967	9,697	9,619	8,652	9,115	10,670	9,105	9,066
88	.....	86.7	88.3	89.0	88.6	84.2	.....	.....
35	37.6	33.78	33.10	37.19	35.5	30.1	35.9	35.64
0.2	0.071	0.21	0.40	0.22	0.23	0.28	0.104	0.13
68	38.9	79.0	50.9	75.8	100	48.5	66.9	66.04
99	98.8	100.0	92.2	100.0	109	112.8	107.2	105.6

Additional information (listed by station number)

332 Also burns 11,205,264 Mcu ft blast furnace gas with 93.8 Btu/cu ft costing 28.1 ¢/million Btu

333, 337 Fixed charges represent depreciation only

342 Also burned 174,597 short tons coke with 15,460 Btu/lb costing 18.7¢/million Btu

Cost and Performance Data o

STATION NUMBER†	346(308)	347	348(266)	349	350	351
GENERAL DATA						
Year, first operation	1954	1954	1951	1953	1957	195
newest unit	1958	1956	1955	1953	1958	195
Total generator rating (MMRC)*	VIII	VII	VII	VII	VII	V
No. of turbogenerators	3	2	3	2	2	
Range of unit ratings*	VI	VI	IV, VI	VI	VI	
No. of boilers	3	2	3	2	2	
Range of ratings (M lb/hr)	700 & 800	1,200	620–800	920	950	75
Steam pressure (psi)	1,550	1,325	1,415–1,525	1,800	1,450	1,87
Steam temp, initial supht (F)	1,000	995	955–1,005	1,000	1,000	1,00
reheat (F)	1,000	.....	1,000–1,005	1,000	1,000	1,00
Cooling water range (F)	58–74	34–85	65–94	52–88	45–90	51–
Corresponding vacuum (in. Hg)	1.27–1.83	1.25–3.25	1.32–2.95	0.90–2.55	1.0–2.0	.71–2
Plant site area (acres)	700	485	59	207	.....	8
In use (acres)	125	75	46.5	.....	.....	
Fuel storage, coal (tons)	.....	1,000,000	100,000	.....	600,000	.....
Oil (bbl)	392,000	1,000	40,000	526,000	.....	40,00
Employees, total	91	103	79	59	81	
Supervision	9	14	3	11	11	
Operation	32	50	41	20	31	
Maintenance	38	22	29	20	23	
Clerical, stores	6	7	5	3	4	
Fuel handling	.....	7	1	.....	6	.....
Guards, laborers	5	3	.....	5	6	.....
OUTPUT DATA						
Total gross gen (kwhr x 10^6)	1,596	1,688	1,307	1,930	835	1,00
Total net gen (kwhr x 10^6)	1,598	1,576	1,216	1,804	786	95
Maximum 1-hr peak (Mw)	334	320	244	280	255	22
Hours operation 1958	8,760	8,760	8,760	8,760	8,760	8,76
FUEL CONSUMPTION						
Coal (tons)	.....	662,866	966	.....	322,882	.....
Btu/lb	.....	13,406	12,500	.....	13,000	.....
Ash (%), Moisture (%)	.....	9.2, 3.3	7.0, 7.0	.....	.....	.....
Cost (¢/million Btu)	.....	34.36	26.77	.....	33.0	.....
Oil (bbl)	830,416	8,590	1,755,004	162,698	.....	13
Btu/gal	153,143	137,527	152,329	152,358	.....	151,92
Cost (¢/million Btu)	39.9	102.26	24.48	53.1	.....	48.5
Gas (M cu ft)	9,526,815	.....	2,552,420	15,970,182	.....	8,771,54
Btu/cu ft	1,090	.....	928	831.4	.....	1,07
Cost (¢/million Btu)	27.63	.....	25.31	31.2	.....	27.3
OPERATING COSTS						
(Mills per net kwhr)						
Wages (incl supervision)	0.251	0.28	0.272	0.145	0.307	0.16
Water, lubrication, supplies	0.046	0.04	0.179	0.108	0.121	0.06
Maintenance	0.228	0.34	0.219	0.114	0.352	0.19
Total, oper & mtce (excl fuel)	0.525	0.66	0.670	0.367	0.780	0.42
Fuel	3.275	3.85	2.758	3.27	3.726	2.71
Total operation (incl fuel)	3.800	4.51	3.428	3.637	4.506	3.13
INVESTMENT DATA						
(Dollars per kw)						
**(310) Land	10.24	1.54	0.53	2.25	0.60	0.5
(311) Structure, improvements	33.69	29.32	24.14	28.19	15.79	10.5
(312) Boiler plant equipment	47.86	58.30	61.51	67.92	65.10	36.1
(314) Turbogenerator unit	40.91	35.07	44.66	45.47	43.96	39.0
(315) Accessory elec equipment	10.72	8.35	10.58	14.09	8.38	9.5
(316) Misc plant equipment	2.29	2.67	0.96	2.65	1.66	1.8
Total station	145.71	135.25	142.38	160.57	135.47	97.6
Outdoor switchyard	7.45	11.23	7.04	15.39	6.61	5.1
Total, station and switchboard	153.16	146.48	149.42	175.96	142.08	102.8
COST OF ENERGY						
(Mills per net kwhr)						
Fixed charges	3.56	2.96	3.555	3.29	4.445	.....
Computed at (%)	15.0	13.08	11.5	13.7	16.0	.....
Operating charges	3.800	4.51	3.428	3.64	4.506	3.13
Total	7.36	7.47	6.983	6.93	8.951	.....
STATION PERFORMANCE 1958						
Billion Btu used	15,726	17,590	13,621	18,166	8,112	9,42
Fuel cost (¢/million Btu)	31.8	34.53	24.63	32.5	33.0	27.3
Btu/net kwhr send out	10,289	11,155	11,199	10,067	10,315	9,90
Btu/gross kwhr generated	9,850	10,420	10,420	9,413	9,713	9,42
Average boiler efficiency (%)	85.0	86.5	88.0	.....	86.4	.....
Station thermal eff, net (%)	33.2	30.6	29.7	35.9	30.2	34.
Employees (Oper & Maint) per Mw	0.233	0.39	0.29	0.163	0.324	0.16
Plant factor, annual (%)	74.0	72.7	55.2	84.0	62.2	47.8
Utilization factor, annual (%)	111.3	120.8	97.0	107.8	108.3	98.1

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

** Electric plant account numbers prescribed by Federal Power Commission.

* Rating groups (Manufacturer's Maximum Rated Capability) Mw; I, 0–19; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

55 Modern Steam Stations

352(275)	353(208)	354	355(276)	356	357	358(321)	359
1949	1951	1954	1949	1956	1954	1955	1954
1957	1955	1954	1957	1956	1957	1956	1956
VII	VII	VII	VII	VII	VII	VII	VII
3	3	2	6	1	2	2	2
III, VI	IV, V	VI	II, III	VII	IV, VI	V, VI	IV, VI
3	3	2	5	1	2	2	2
400 & 750	600 & 575	950	425 & 493	1,150	620 & 765	525 & 740	650 & 750
875 & 1,500	1,500 & 1,675	1,525	1,250	1,925	1,500 & 1,525	1,500	1,250 & 1,450
905 & 1,000	950 & 1,000	1,005	950	1,005	955 & 1,005	1,005	995 & 1,005
1,000	1,000	.....	.....	1,005	1,005	1,005	1,005
33–85	34–81	48–90	32–67	30–78	63–91	62–88	74–90
0.50–2.50	0.80–2.35	0.32–2.92	0.5–1.5	0.8–2.50	0.98–2.52	1.12–2.30	1.0–3.1
45	114	680	70	128	10.5	1,616	400
45	91	680	60	28	10.5	322	100
150,000	150,000	.....	53,000	174,000	32,000	132,000	.....
714	80,000	35,800	110,000	.....	.....	850	55,000
113	95	53	146	61	51	66	37
8	15	2	12	7	3	11	2
57	30	23	83	18	26	23	18
23	23	20	34	21	15	14	8
3	8	1	5	4	3	7	1
16	8	.....	6	7	4	10	.....
6	11	7	6	4	.....	1	8
1,508	1,242	1,227	1,054	1,097	1,095	994	628
1,431	1,174	1,158	998	1,036	1,023	924	588
216	214	215.4	200.7	196	172.0	190	170
8,760	8,760	8,760	8,760	8,505	8,760	8,760	8,760
646,698	343,861	.....	157,783	372,759	433,215	431,107	.....
11,570	13,356	.....	12,360	13,287	12,555	11,131	.....
16.7, 8.4	8.2, 3.7	.....	6.0, 5.0	8.0, 4.1	7.0, 7.0	8.4, 14.2	.....
32.91	35.5	.....	44.8	39.2	20.57	22.54	.....
10,907	12,852	211	1,108,000	.....	4,470	611	.....
136,900	145,481	154,095	148,000	.....	140,000	140,000	.....
79.16	46.84	30.0	39.4	.....	89.90	80.60	.....
.....	2,992,000	12,236,723	.....	.....	.....	.....	.....
.....	1,055	1,067	.....	.....	.....	.....	.....
.....	35.78	13.8	.....	.....	.....	.....	.....
0.343	0.273	0.15	0.55	0.239	0.256	0.330	0.29
0.055	0.067	0.01	0.10	0.114	0.071	0.038	0.08
0.251	0.375	0.20	0.65	0.210	0.165	0.169	0.20
0.649	0.714	0.36	1.20	0.562	0.492	0.537	0.57
3.444	3.708	1.55	4.40	3.833	2.217	2.344	1.69
4.093	4.422	1.91	5.60	4.343	2.709	2.881	2.26
1.61	0.46	1.43	0.59	5.4	1.32	3.40	0.68
39.53	33.69	14.10	45.10	28.0	24.42	33.43	.....
58.02	72.52	30.70	68.50	63.8	61.51	66.79	.....
42.90	47.13	35.10	44.60	40.9	40.30	48.73	.....
13.71	14.50	5.84	10.32	6.2	10.30	13.25	.....
1.82	2.37	0.39	2.01	1.1	1.61	2.71	.....
157.59	170.67	87.56	171.12	145.4	139.46	168.31	.....
6.70	12.02	11.24	8.06	3.9	4.79	12.32	.....
164.29	182.69	98.80	179.18	149.3	144.25	180.63	92.52
3.616	.....	2.56	4.77	3.604	2.833	4.304	0.0
15.0	.....	15.0	14.0	13.4	11.5	13.5	.....
4.093	4.422	1.91	5.60	4.343	2.709	2.881	2.26
7.709	.....	4.47	10.37	7.947	5.542	7.185	2.26
15,028	12,222	13,058	10,784	10,066	10,878	9,601	6,788
32.8	32.55	13.8	40.6	39.2	20.74	22.56	14.65
10,500	10,411	11,277	10,800	9,711	10,622	10,393	11,546
9,960	9,836	10,643	10,220	9,177	9,953	9,660	10,806
88.0	89.9	82.5	86.0	88.0	88.0	89.0	80.8
32.5	32.8	30.3	31.4	35.1	29.7	32.8	29.56
0.538	0.256	0.265	0.77	0.328	0.25	0.19	0.206
82.0	64.74	70.0	60.2	69.7	63.9	58.5	41.21
102.9	103.35	107.7	105.2	105.0	94.2	97.9	97.7

STATION NUMBER†	360(214)	361	362	363	364(227)	365(318)
GENERAL DATA						
Year, first operation	1950	1956	1953	1956	1951	19
newest unit	1956	1956	1956	1959	1956	19
Total generator rating (MMRC)*	VII	VI	VI	VI	VI	
No. of turbogenerators	4	1	3	1	2	
Range of unit ratings*	II, IV	VI	II, V	VI	II, V	
No. of boilers	4	1	3	1	2	
Range of ratings (M lb/hr)	300 & 650	860	350 & 600	950	350 & 550	200 & 3
Steam pressure (psi)	875	1,800	870–1,450	1,875	920 & 1,550	8
Steam temp, initial supht (F)	910 & 1,005	1,000	900 & 1,000	1,000	905 & 1,005	9
reheat (F)	.....	1,000	1,000	1,000	1,005	.....
Cooling water range (F)	45–90	42–72	65–80	33–84	48–93	60
Corresponding vacuum (in. Hg)	0.64–2.30	1.1–1.5	1.0–1.5	0.70–2.22	.....	1.2–2
Plant site area (acres)	78	130	912	116	123	
In use (acres)	38	100	.....	65	33	
Fuel storage, coal (tons)	.....	400,000	.....	350,000	.....	.....
Oil (bbl)	.....	.....	135,000	1,190	155,000	30,
Employees, total	43	84	62	59	47	
Supervision	2	18	2	2	4	
Operation	30	33	41	25	24	
Maintenance	8	14	13	11	17	
Clerical, stores	1	5	1	2	2	
Fuel handling	.....	11	.....	9	.....	
Guards, laborers	2	3	5	10	.....	
OUTPUT DATA						
Total gross gen (kwhr x 10^6)	1,218	901	476	1,016	746	3
Total net gen (kwhr x 10^6)	1,173	850	446	958	713	3
Maximum 1-hr peak (Mw)	186	134	112	134	128	
Hours operation 1958	8,760	8,760	8,760	8,133	8,736	8,7
FUEL CONSUMPTION						
Coal (tons)	.....	312,200	.....	343,070	.....	.....
Btu/lb	.....	11,678	.....	13,551	.....	.....
Ash (%), Moisture (%)	.....	8.1, 10.8	.....	7.6, 3.4	.....	.....
Cost (¢/million Btu)	.....	30.0	.....	37.48	.....	.....
Oil (bbl)	.....	.....	111,528	2,301	1,216,284	751,0
Btu/gal	.....	.....	151,000	139,338	150,829	154,1
Cost (¢/million Btu)	.....	.....	51.29	.....	38.5	41
Gas (M cu ft)	13,248,292	543,108	4,281,272	.....	.....	.....
Btu/cu ft	1,047	1,000	1,000	.....	.....	.....
Cost (¢/million Btu)	12.51	30.18	33.22	.....	.....	.....
OPERATING COSTS						
(Mills per net kwhr)						
Wages (incl supervision)	0.149	0.31	0.649	0.413	0.26	0.6
Water, lubrication, supplies	0.012	0.08	.....	0.066	0.08	0.0
Maintenance	0.089	0.29	0.344	0.266	0.29	0.3
Total, oper & mtce (excl fuel)	0.250	0.68	0.993	0.745	0.63	1.0
Fuel	1.48	2.91	4.400	3.649	4.16	5.4
Total operation (incl fuel)	1.73	3.59	5.393	4.394	4.79	6.4
INVESTMENT DATA						
(Dollars per kw)						
**(310) Land	0.59	7.78	0.22	1.48	0.26	0.
(311) Structure, improvements	15.67	47.21	27.03	57.43	15.56	16.
(312) Boiler plant equipment	31.47	58.02	50.32	64.11	42.82	30.
(314) Turbogenerator unit	36.87	44.31	57.54	36.47	36.33	54.
(315) Accessory elec equipment	5.66	14.77	10.77	19.71	8.69	8
(316) Misc plant equipment	1.41	1.86	0.59	1.93	1.43	0.
Total station	91.67	173.95	146.47	181.13	105.09	109.
Outdoor switchyard	8.57	12.19	8.33	.....	.....	1.
Total, station and switchyard	100.24	186.13	154.80	.....	.....	111.
COST OF ENERGY						
(Mills per net kwhr)						
Fixed charges	2.08	4.26	3.100	3.682	3.21	3.3
Computed at (%)	14.0	16.0	14.7	14.75	17.0	.....
Operating charges	1.73	3.59	5.393	4.394	4.79	6.4
Total	3.81	7.85	8.493	8.076	8.00	9.8
STATION PERFORMANCE 1958						
Billion Btu used	13,860	835	5,398	9,324	7,705	4,7
Fuel cost (¢/million Btu)	12.51	29.9	35.69	37.48	38.5	41
Btu/net kwhr send out	11,821	9,823	11,457	9,736	10,805	14,2
Btu/gross kwhr generated	11,390	9,266	10,734	9,173	10,323	13,4
Average boiler efficiency (%)	84.6	84.5	84.25	89.4	.....	86
Station thermal eff, net (%)	28.8	34.8	29.78	35.1	31.6	25
Employees (Oper & Maint) per Mw	0.247	0.646	0.46	0.273	0.32	0.4
Plant factor, annual (%)	81.2	86.7	40.21	83.1	66	4
Utilization factor, annual (%)	83.8	102.8	82.13	100.0	100	6

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

** Electric plant account numbers prescribed by Federal Power Commission.

* Rating groups (Manufacturer's Maximum Rated Capability) Mw: I, 0–1; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; VIII, 300–499; IX, 500 up.

55 Modern Steam Stations

366	367	368(323)	369	370	371	372	373
1957	1957	1952	1952	1956	1949	1957	1957
1957	1957	1957	1954	1957	1957	1957	1958
VI	VI	VI	VI	VI	VI	VI	VI
1	1	4	2	2	3	1	2
VI	VI	II	II, V	III, IV	II, III	VI	IV
1	1	4	2	2	3	1	2
975	750	200–335	350 & 642	425 & 550	260–425	852	475
1,550	1,750	975–1,000	900 & 1,350	1,260 & 1,850	600–1,250	1,550	1,850
1,005	1,000	910	905 & 955	960 & 1,005	825–950	1,005	1,000
.....	1,000	.....	.....	1,005	.....	1,005	1,000
48–88	56–95	76–93	54–104	66–90	70–100	60–85	65–82
0.68–2.58	0.97–2.61	1.5–2.1	0.75–4.90	0.91–2.4	1.5–3.0	1.0–2.0	1.1–2.0
132.5	660	22	47.5	90	.....	130	80
38.4	75	17	12	26	.....	50	45
.....	215,000	.....	.....	.....	.....	700,000	.....
25,000	.....	45,000	10,500	60,000	45,000	.....	250,000
33	41	37	51	29	36	42	31
5	6	1	9	2	6	7	4
19	18	26	25	18	28	21	18
9	9	8	14	7	2	8	6
.....	1	1	3	1	.....	2	3
.....	5	.....	.....	.....	.....	3	.....
.....	2	1	.....	1	.....	.....	.....
716	644	629	473	454	200	763	903
689	600	590	447	430	182	714	859
122	112	107	113.6	126.3	101.0	118	134
8,287	8,444	8,760	8,760	8,634	8,760	7,451	8,760
.....	246,102	.....	.....	.....	.....	80,454	.....
.....	12,406	.....	.....	.....	.....	10,229	.....
.....	8, 5	.....	.....	.....	.....	6.5, 20	.....
.....	23	.....	.....	.....	.....	26.96	.....
795	.....	1,598	265	.....	76,565	.....	42,984
149,522	.....	139,273	150,289	.....	153,608	.....	153,042
53.70	.....	22.10	49.11	.....	47.123	.....	49.42
6,781,385	.....	6,897,336	4,809,076	4,116,418	1,914,296	7,206,090	7,569,246
1,094	.....	1,082	1,085	1,079	1,100	836	1,092
12.15	.....	18.85	27.19	36.94	41,673	19.12	31.29
0.247	0.291	0.37	0.369	0.268	0.960	0.376	0.180
0.036	0.057	0.04	0.061	0.211	0.244	0.067	0.073
0.156	0.248	0.12	0.357	0.198	0.484	0.037	0.133
0.439	0.596	0.53	0.787	0.677	1.698	0.480	0.386
1.311	2.314	2.38	3.178	3.820	6.108	2.250	3.169
1.750	2.910	2.91	3.965	4.497	7.806	2.730	3.941
2.94	1.95	0.33	0.540	0.55	0.26	5.84	4.73
19.19	23.00	15.54	12.783	13.85	25.79	22.06	6.91
35.35	51.12	39.77	41.734	50.15	52.46	83.22	51.35
34.48	38.60	52.35	39.720	56.60	49.63	54.81	63.84
8.03	8.76	19.75	11.653	9.47	11.65	13.62	9.31
2.60	1.61	1.61	1.304	1.18	6.79	1.13	0.91
102.59	125.04	129.35	107.734	131.80	146.58	180.68	137.05
6.24	8.42	7.49	7.741	18.47	.....	9.05	8.77
108.83	133.46	136.84	115.475	150.27	.....	189.73	145.82
3.440	2.063	4.08	.....	.....	.....	3.29	2.806
18.16	8.16	16.1	.....	.....	.....	12.4	13.4
1.750	2.910	2.91	3.965	.....	.....	2.730	3.941
5.190	4.973	6.99	.....	.....	.....	6.02	6.747
7,424	6,105	7,474	5,218	4,418	2,600	7,670	8,439
12.17	23	18.85	27.20	36.94	42.7	20.80	31.88
10,768	10,175	12,674	11,681	10,342	14,300	10,736	9,941
10,362	9,500	11,883	11,042	9,794	12,967	10,055	9,462
85.5	88	82.5	.....	84	85	85.0	85.0
32.5	33.6	27.0	29.2	33.0	23.9	31.81	34.33
0.233	0.351	0.325	0.356	0.279	.....	0.42	0.182
69.3	55	59.0	46.57	49.78	24.3	87	78.1
101.7	98	93.7	103.74	121.4	107.4	118	101.5

ditional information (listed by station number)

Operating cost (mills per net kwhr) entry for wages includes water, ication and supplies also

372 Station performance entry on fuel cost (¢ per million Btu) includes initial and freight cost

STATION NUMBER†	374(329)	375	376	377	378	379
GENERAL DATA						
Year, first operation	1955	1955	1957	1957	1949	19
newest unit	1957	1957	1957	1957	1958	19
Total generator rating (MMRC)*	V	V	V	V	IV	
No. of turbogenerators	2	2	1	1	5	
Range of unit ratings*	III	III	V	V	I, II	II,
No. of boilers	2	2	1	1	5	
Range of ratings (M lb/hr)	400 & 450	425	650	625	80–200	200 & 2
Steam pressure (psi)	875	1,250 & 1,450	1,850	1,350	650–875	1,050 & 1,4
Steam temp, initial supht (F)	910	950	1,005	950	825–910	910 & 1,0
reheat (F)			1,005			1,0
Cooling water range (F)	43–86	59–73	32–90	50–90	80–90	50–
Corresponding vacuum (in. Hg)	1.5–3.0	0.75–1.68	0.6–2.2	1.0–3.25	1.7–2.0	1.0–3
Plant site area (acres)	15	6.57	481	160	8.72	
In use (acres)	15	3.77	62.7	103	8.72	
Fuel storage, coal (tons)	75,000		200,000			
Oil (bbl)		100,000	5,952		4,760	
Employees, total	52	30	58	27	44	
Supervision	5	1	8	3	4	
Operation	21	18	23	15	21	
Maintenance	7	10	11	6	18	
Clerical, stores	2	1	2	1	1	
Fuel handling	6		3			
Guards, laborers	11		11	2		
OUTPUT DATA						
Total gross gen (kwhr x 10^6)	458	313	543	236	189	2
Total net gen (kwhr x 10^6)	434	289	508	217	173	3
Maximum 1-hr peak (Mw)	87	100	87	79	41.1	74
Hours operation 1958	8,760	8,760	8,760	8,760	8,760	8,7
FUEL CONSUMPTION						
Coal (tons)	121,938		202,592			
Btu/lb	11,641		12,531			
Ash (%), Moisture (%)	12.1, 9.7		10.2, 6.5			
Cost (¢/million Btu)	26.73		36.22			
Oil (bbl)		62,070	13,596			
Btu/gal		149,000	138,468			
Cost (¢/million Btu)		48	78.37			
Gas (M cu ft)	2,284,003	2,756,143			2,560,000	3,375,5
Btu/cu ft	1,015	1,100		1,000	1,020	1,0
Cost (¢/million Btu)	17.74	31		19.2	16.2	15.2
OPERATING COSTS						
(Mills per net kwhr)						
Wages (incl supervision)	0.64	0.678	0.34	0.39	0.872	0.4
Water, librication, supplies	0.23	0.196	0.11	0.11	0.103	0.0
Maintenance	0.27	0.211	0.26	0.35	0.31	0.0
Total, oper & mtce (excl fuel)	1.14	1.08	0.71	0.85	1.285	0.6
Fuel	2.69	3.87	3.74	2.25	2.435	1.7
Total operation (incl fuel)	3.83	4.97	4.45	3.10	3.72	2.3
INVESTMENT DATA						
(Dollars per kw)						
**(310) Land	1.48	0.26	2.163	1.16	0.23	0.2
(311) Structures, improvements	20.38	11.08	49.587	19.03	38.50	10.4
(312) Boiler plant equipment	63.52	52.35	81.843	38.44	26.80	37.1
(314) Turbogenerator unit	65.46	60.63	61.158	53.13	34.00	35.5
(315) Accessory equipment	19.50	16.72	19.597	8.67	9.90	12.3
(316) Misc plant equipment	3.13	0.83	6.950	1.46	2.00	10.4
Total station	173.47	141.97	221.299	121.89	110.93	94.9
Outdoor switchyard		2.63	11.341	4.80		4.2
Total, station and switchyard		144.60	232.640	126.69		106.2
COST OF ENERGY						
(Mills per net kwhr)						
Fixed charges		2.90		5.71		3.5
Computed at (%)		6.7		13.06		12.
Operating charges	3.83	4.97	4.45	3.10	3.72	2.3
Total		7.87		8.81		5.8
STATION PERFORMANCE 1958						
Billion Btu used	5,156	3,420	5,156	2,544	2,610	3,5
Fuel cost (¢/million Btu)	22.69	32.8	36.86	19.2	16.2	15.2
Btu/net kwhr send out	11,870	11,824	10,150	11,718	15,050	11,3
Btu/gross kwhr generated	11,264	10,929	9,495	10,789	13,890	10,8
Average boiler efficiency (%)	85.4	83.7	88.5	85.2	76	88
Station thermal eff, net (%)	30.3	28.9	33.63	29.12		30
Employees (Oper & Maint) per Mw	0.62	0.357	0.605	0.36	0.55	0.3
Plant factor, annual (%)	62.2	42	61	38.7	27	47
Utilization factor, annual (%)	103.5	119	100	105.3	50.6	94

† Numbers continue from previous surveys. Parentheses enclose old numbers of plants since modified.

** Electric plant account numbers prescribed by Federal Power Commission

* Rating groups (Manufacturer's Maximum Rated Capability) Mw; I, 0-1[illegible]; II, 20–39; III, 40–59; IV, 60–74; V, 75–99; VI, 100–149; VII, 150–299; V[illegible] 300–499; IX, 500 up.

5 Modern Steam Stations

380	381	382	383	384	385	386
1953	1958	1950	1954	1957	1953	1957
1957	1958	1956	1954	1957	1955	1957
IV	III	III	III	III	II	II
3	1	2	1	1	2	1
II	III	II	III	II	I	II
3	1	2	1	2	2	1
176	375	200 & 240	425	220	170	215
900	1,450	900	920	850	875	875
900	1,000	900	910	900	910	910
.....	1,000	.....	.....	.....	.....	.....
58-97	46-78	67-93	45-86	36-85	60-90	39-73
1.0-2.5	0.5-1.75	0.5-1.8	0.62-1.87	1.5-2.5	0.9-2.7	0.5-1.5
315	64	11	15	40	60	114
15	40	10	2.8	10	30	7
30,000	120,000	.....	.....	100,000	.....	30,000
.....	10,500	30,000	.....	.....	15,330	357
41	28	53	24	41	20	28
4	2	4	2	8	2	6
24	15	33	15	19	14	16
6	4	7	5	12	4	3
1	1	2	1	1	.....	1
2	4	2	.....	.....	.....	1
4	2	5	1	.....	.....	1
357	177	184	214	206	223	117
332	167	172	204	197	207	108
66.7	53.2	47.5	53.8	48.0	41.5	26.0
8,760	.....	8,760	7,625	8,760	8,760	8,164
193,955	64,486	.....	.....	21,390	.....	59,715
9,577	12,851	.....	.....	13,000	.....	11,734
14.4, 17.6	8, 4	.....	.....	11, 12	.....	11.0, 7.5
23.0	30.7	.....	.....	20.3	.....	22.04
.....	20,070	365,114	.....	.....	312	5,466
.....	149,000	148,000	.....	.....	132,000	138,802
.....	39.2	45.3	.....	.....	49.5	94.46
.....	.....	.....	2,128,410	1,781,983	2,712,173	.....
.....	.....	.....	1,094	1,091	970	.....
.....	.....	.....	17.15	19.2	21.7	.....
0.47	0.55	1.751	0.456	0.734	0.27	1.49
0.17	0.05	.....	0.085	0.074	0.21	0.19
0.29	0.02	0.973	0.259	0.201	0.17	0.13
0.93	0.62	2.724	0.800	1.009	0.65	1.81
2.98	3.56	6.046	1.96	2.48	2.76	3.23
3.91	4.18	8.770	2.76	3.489	3.41	5.04
0.91	0.6	.....	1.33	11.36	0.68	4.5
44.71	26	.....	17.84	101.65	23.90	40.4
59.18	103	.....	40.99	43.22	52.00	85.8
65.61	55	.....	45.04	33.84	50.80	69.7
15.65	14	.....	7.91	8.54	14.85	29.1
2.32	4	.....	2.79	15.56	1.05	1.1
188.38	202.6	.....	115.90	214.17	143.22	230.6
9.23	8	.....	9.76	2.71	15.00	13.2
197.61	210.6	.....	125.66	216.88	158.22	243.8
6.68	6.3	.....	3.79	2.769	2.46	6.96
17.0	15	.....	14	5.7	.....	12.4
3.91	4.18	8.770	2.76	3.489	3.41	5.04
10.59	10.48	.....	6.55	6.258	5.87	12.00
4,368	1,780	2,269	2,330	2,507	2,633	1,433
23.0	33	45.3	17.15	19.42	21.75	23.656
13,157	10,691	13,192	11,410	12,753	12,710	13,194
12,215	10,075	12,298	10,900	12,128	11,510	12,241
85.3	80	83	87	83	85	85.7
25.90	31.9	25.9	29.8	27	26.9	25.88
0.62	0.37	0.84	0.546	.07	0.545	1.20
57.3	67	44.2	52.1	51 0	65.1	53.5
101	102	99.4	63.6	109.1	103.7	104.0

ditional information (listed by station numbers):

Operating costs (mills per net kwhr) item for maintenance and repairs
des also water, lubrication and supplies

384 Boiler efficiency listed is for gas fuel. With coal it is 85%

Steam Station Space Factors

BOILER ROOM (CU FT/KW)

Mw Range	Max	Min	Avg
0–19	.....	.....	.....
20–39	.....	.....	2.84
40–59	.....	.....	12.20
60–74	.....	.....	9.00
75–99	14.97	9.17	12.07
100–149	15.11	3.16	11.27
150–299	16.36	10.06	13.76
300–499	15.67	5.27	11.50
500 & Up	13.89	9.23	11.11

TURBINE ROOM (CU FT/KW)

Mw Range	Max	Min	Avg
0–19	.....	.....	.....
20–39	.....	.....	7.61
40–59	11.60	2.20	5.70
60–74	7.94	5.00	6.47
75–99	9.53	2.63	6.69
100–149	12.25	2.69	6.30
150–299	10.13	1.27	5.16
300–499	14.40	7.01	8.54
500 & Up	10.78	6.35	7.83

SWITCHHOUSE (CU FT/KW)

0–19	.....	.....	.....
20–39	.....	.....	0.04
40–59	.36	0.30	0.33
60–74	.....	.....	0.29
75–99	.....	.....	1.66
100–149	2.90	0.09	0.71
150–299	0.31	0.07	0.18
300–499	0.94	0.04	0.32
500 & Up	1.02	0.19	0.47

OFFICE (CU FT/KW)

0–19	.....	.....	.....
20–39	.....	.....	.....
40–59	1.5	0.20	0.72
60–74	2.8	0.42	1.61
75–99	2.7	0.49	1.36
100–149	6.10	0.27	1.27
150–299	1.41	0.08	0.44
300–499	1.72	0.08	0.63
500 & Up	3.38	0.15	1.27

BUILDING, GROUND AREA (SQ FT/KW)

0–19	.....	.....	.....
20–39	9.3	0.31	4.80
40–59	9.1	0.20	4.65
60–74	0.3	0.23	0.26
75–99	0.45	0.17	0.30
100–149	2.10	0.18	0.48
150–299	2.76	0.15	0.48
300–499	0.25	0.18	0.20
500 & Up	0.35	0.19	0.23

SWITCHYARD (SQ FT/KW)

0–19	.....	.....	.....
20–39	.....	.....	.....
40–59	1.9	0.27	0.82
60–74	0.22	0.07	0.15
75–99	1.64	0.15	0.73
100–149	0.86	0.05	0.43
150–299	0.83	0.05	0.34
300–499	0.53	0.11	0.28
500 & Up	0.48	0.08	0.21

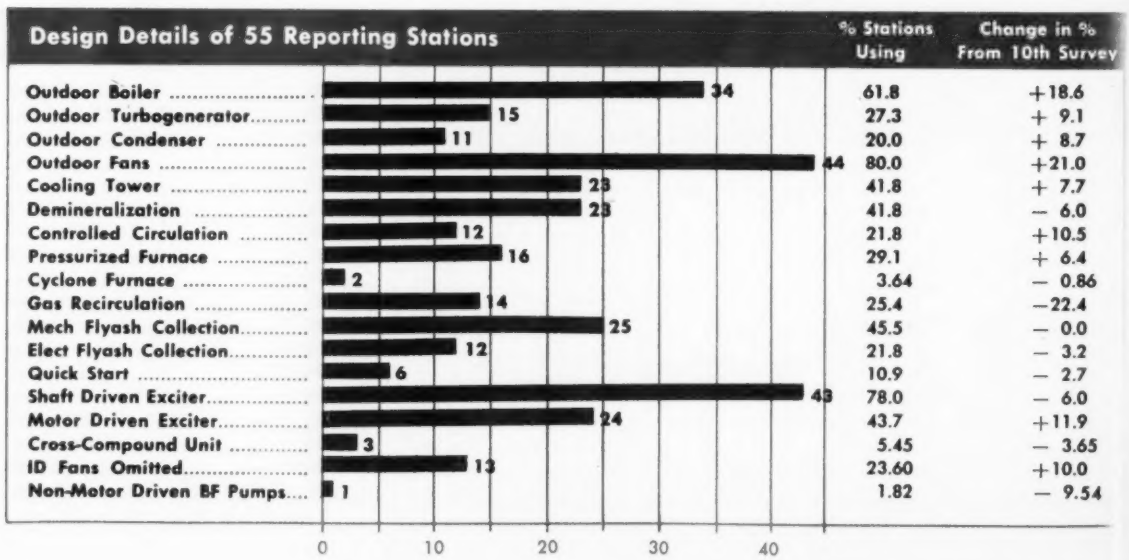
FUEL STORAGE AREA (SQ FT/KW)

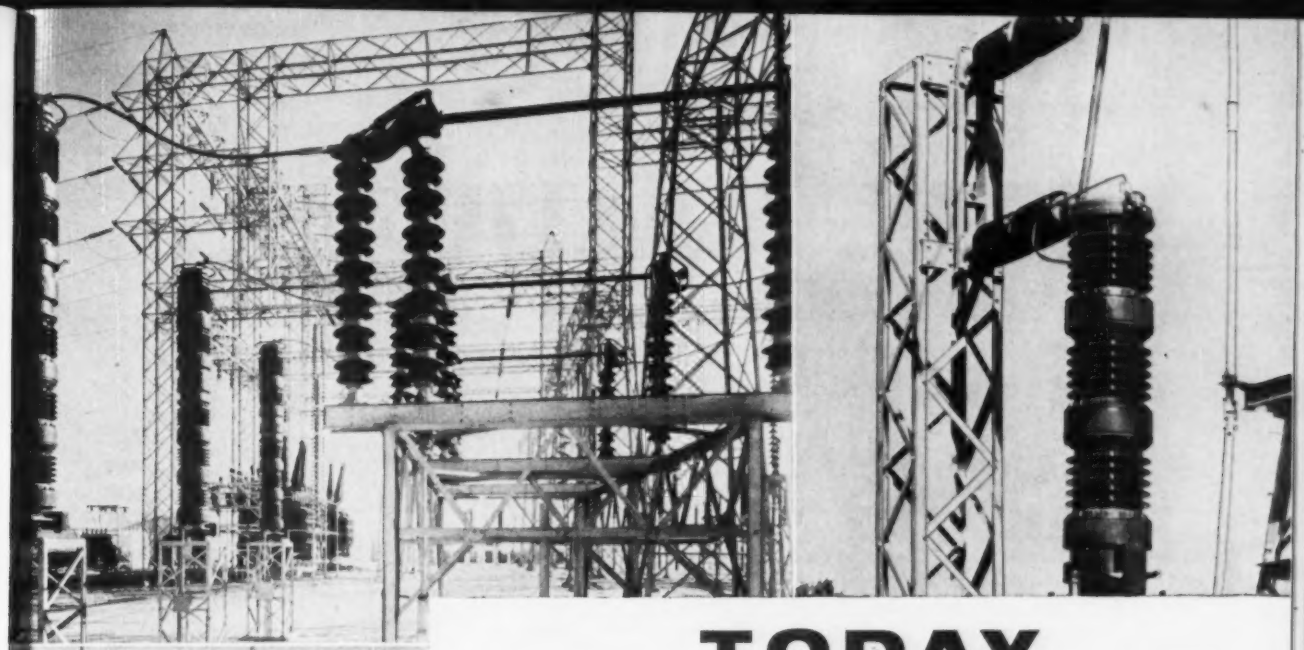
0–19	.....	.....	.....
20–39	5.5	0.90	3.20
40–59	2.5	0.68	1.59
60–74	3.0	0.05	1.52
75–99	4.91	0.52	2.71
100–149	10.0	0.17	1.88
150–299	1.7	0.24	0.94
300–499	2.46	0.22	1.16
500 & Up	1.74	0.54	0.74

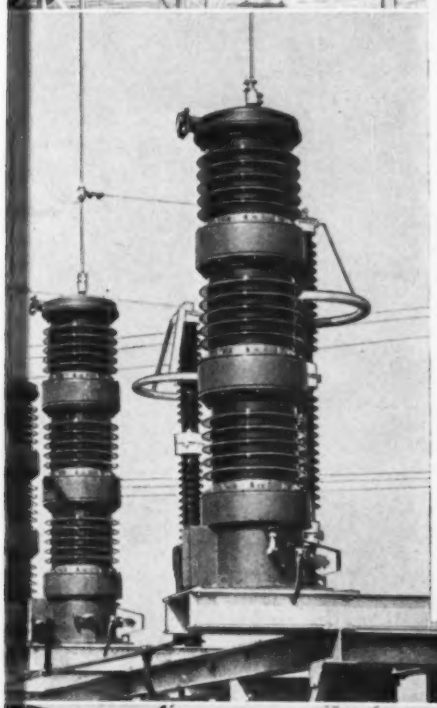
COAL STORAGE (TONS/KW)

0–19	.....	.....	.....
20–39	.....	.....	1.20
40–59	.....	.....	0.68
60–74	.....	.....	0.46
75–99	2.1	0.19	1.14
100–149	2.15	0.32	1.15
150–299	0.94	0.19	0.55
300–499	1.76	0.38	0.79
500 & Up	2.14	0.65	1.22

Design Details of 55 Reporting Stations


% Stations Using
Change in % From 10th Survey
Outdoor Boiler 34 61.8 +18.6
Outdoor Turbogenerator 15 27.3 + 9.1
Outdoor Condenser 11 20.0 + 8.7
Outdoor Fans 44 80.0 +21.0
Cooling Tower 23 41.8 + 7.7
Demineralization 23 41.8 − 6.0
Controlled Circulation 12 21.8 +10.5
Pressurized Furnace 16 29.1 + 6.4
Cyclone Furnace 2 3.64 − 0.86
Gas Recirculation 14 25.4 −22.4
Mech Flyash Collection 25 45.5 − 0.0
Elect Flyash Collection 12 21.8 − 3.2
Quick Start 6 10.9 − 2.7
Shaft Driven Exciter 43 78.0 − 6.0
Motor Driven Exciter 24 43.7 +11.9
Cross-Compound Unit 3 5.45 − 3.65
ID Fans Omitted 13 23.60 +10.0
Non-Motor Driven BF Pumps 1 1.82 − 9.54
0
10
20
30
40





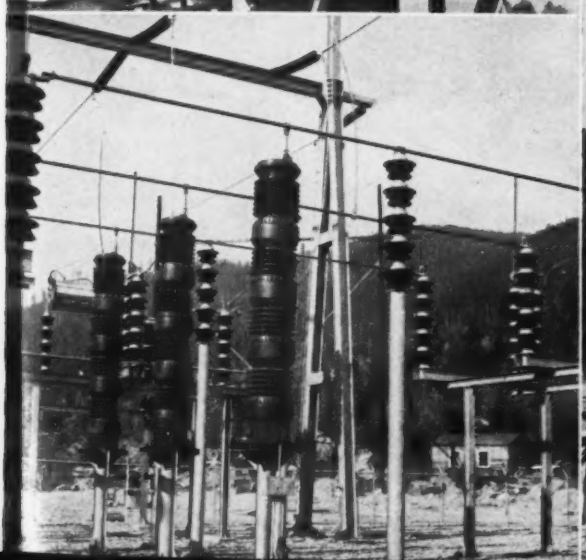
TODAY NEARLY 1,000

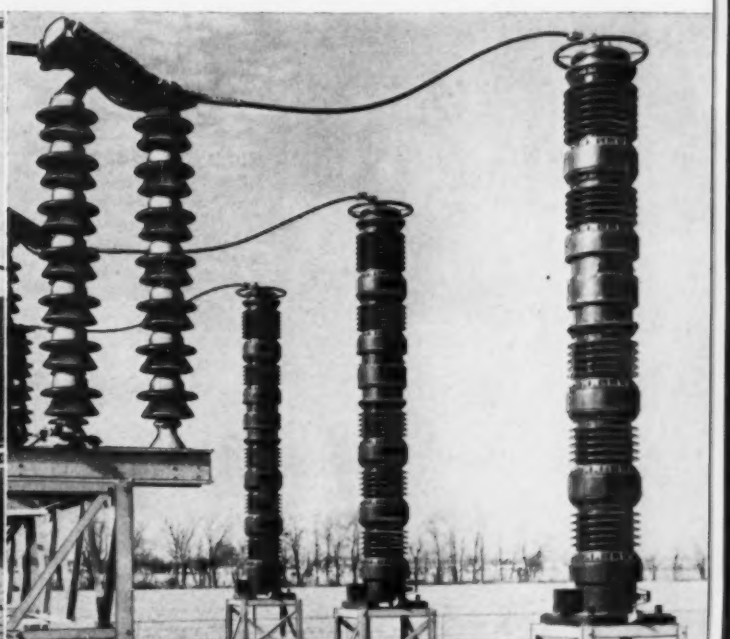
General Electric cascade transformers are in service . . . without a single electrical failure being reported. This is transformer reliability.

General Electric Company, Section 629-3, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC





be sure to consider...

TOTAL VALUE

General Electric Master Unit Substations are your best "total value" buy—most advanced transformer, switchgear designs . . . completely integrated for modern, economical power distribution

For a "total value" product appraisal, consider these over-all advantages of factory-built unit substations, then factor in the product superiority of G-E transformer and switchgear components.

Centralized responsibility with General Electric means you get a modern, integrated, expertly engineered product like the unit substation shown below which supplies power for United States Gypsum Company's new plant at Galena Park, Texas. Your engineering staff is freed for other projects.

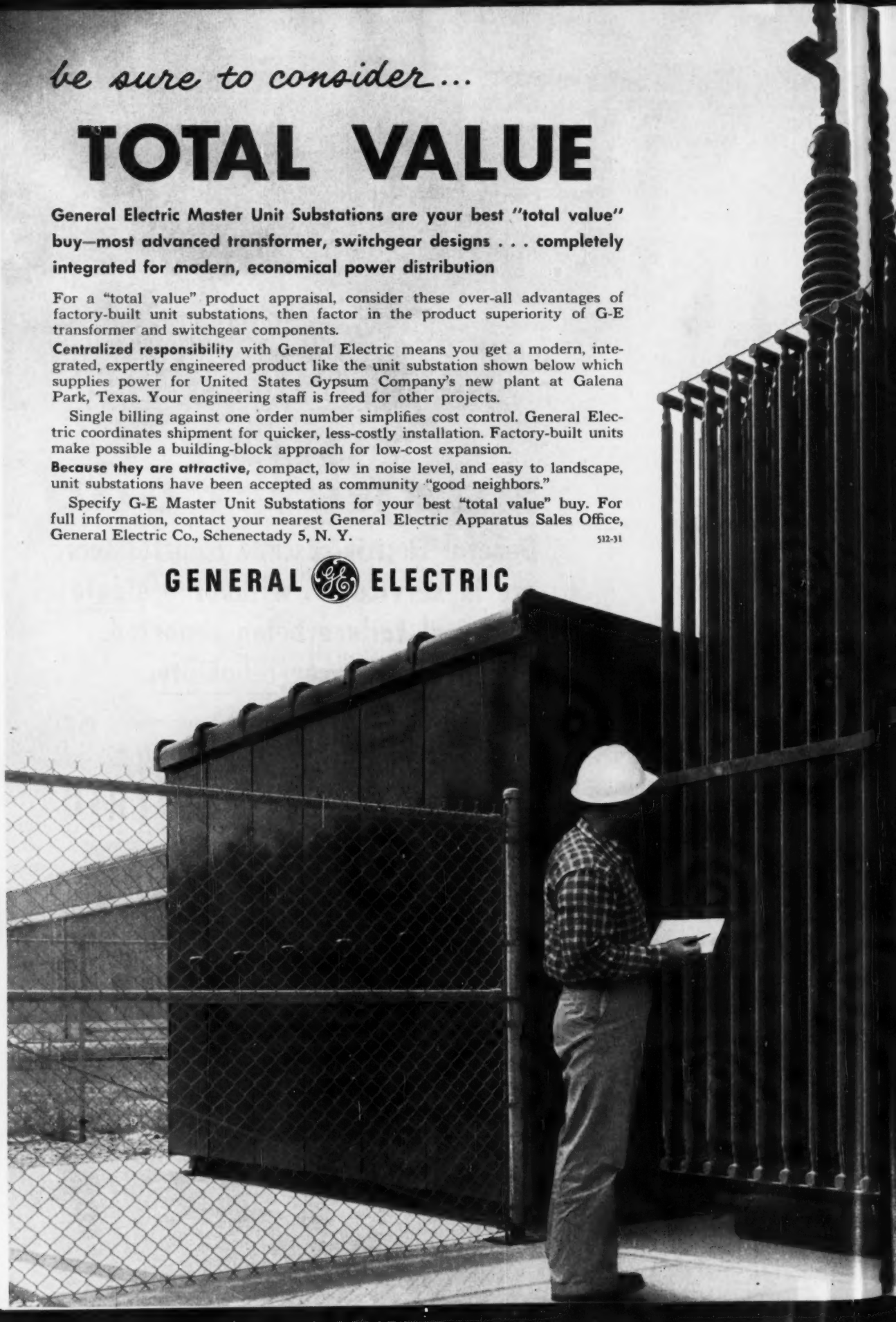
Single billing against one order number simplifies cost control. General Electric coordinates shipment for quicker, less-costly installation. Factory-built units make possible a building-block approach for low-cost expansion.

Because they are attractive, compact, low in noise level, and easy to landscape, unit substations have been accepted as community "good neighbors."

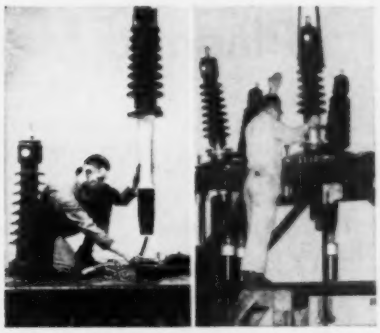
Specify G-E Master Unit Substations for your best "total value" buy. For full information, contact your nearest General Electric Apparatus Sales Office, General Electric Co., Schenectady 5, N. Y.

512-31

GENERAL ELECTRIC

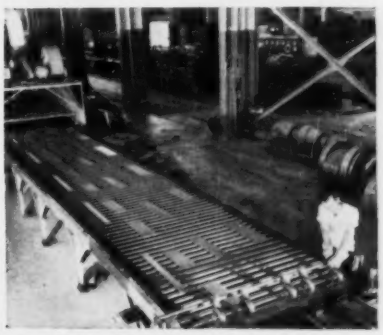


These transformer features are part of G-E Unit Substation value

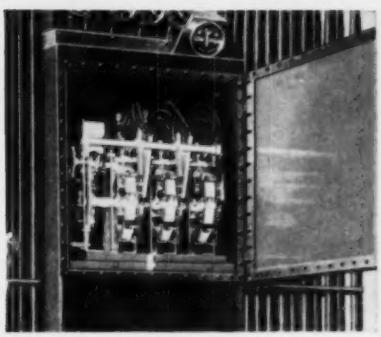


INTERCHANGEABLE BUSHINGS can be converted easily from transformer to breaker application to cut bushing inventory significantly.

PRESSURE-RELIEF DEVICE gives tank protection from excessive internal pressures. Direct-acting mechanical device is rugged, self-resealing.



TEN PERCENT LOWER CORE LOSSES, sound levels 2 to 3 db below industry standards result from new core steel annealing process.



NEW LOAD TAP CHANGER cuts routine maintenance 50% by doubling contact-tip life. Peak operating noise is reduced 20 db.

Planned Maintenance Preserves Machines

J. S. **JOHNSON**, Services Engineering Manager, Maintenance and Renewal Parts Section, Large Rotating Apparatus Dept, Westinghouse Electric Corp, East Pittsburgh, Pa.

Time of Inspection

All large high-voltage rotating machines should be inspected at periodic intervals; the first inspection should be made jointly by manufacturer and user after about one year of operation. The time for subsequent inspections can be determined on the basis of conditions found during the first inspection. Steam and hydraulic generator inspections can be made during turbine inspection periods to reduce out-of-service time to the minimum.

Two major considerations are involved: maintenance cost (both in time and money) vs the cost of service failures, and value of increased machine reliability.

Inspection

A thorough visual examination is the basis of a sound maintenance inspection program. No test methods are available, or are likely to be developed, which will make it unnecessary to periodically examine equipment visually to determine its physical condition. Such inspections should be principally directed at an evaluation of the mechanical condition of the insulation.

Tests

Electrical tests, useful supplements to visual inspection, determine the suitability of machine insulations for service or disclose conditions in need of corrective maintenance.

No single test will provide all desired information about insulation conditions. However, the combination of thorough visual inspection and proper interpretation of available electrical tests permits a reasonable estimate of insulation condition. Reasonable extrapolation of performance trends established from periodic testing is justified to predict when machine winding will need repair or replacement.

Test Classification

Maintenance tests may be grouped into two classifications: overpotential tests on ground or conductor insulation, and slot discharge tests. These provide a basis of decision at the time of test—the winding either passes or fails. If failure occurs, repairs or suitable corrective action must be undertaken.

Ground Insulation Tests

Some common tests used for maintenance evaluation are directed at determining the condition of ground insulation. Currently, nine years' field experience of the Westinghouse maintenance inspection program has corroborated laboratory conclusions that showed advantages of dc test potentials for examining ground insulations.

Properly selected values of dc potentials are as searching as ac potentials and do not have similar deteriorating effects on good insulation. Hundreds of dc overpotential tests have been made on machines during maintenance overhaul; in all cases, test failures led to the discovery of insulation in need of repair. The overpotential test values currently recommended appear to provide results assuring insulation strength sufficient for normal operation.

Along with the use of dc as a proof test, attention has been focused on change in leakage as a function of increasing test voltage. Evidence indicates that abnormal leakage behavior may be interpreted in terms of impending failure or other conditions requiring correction.

Conductor Insulation Tests

Equally important, but usually more difficult to test, is the insulation between conductors. If appreciable overvoltage between turns is necessary to test conductor insulation, some form of surge test is generally used. This may involve either direct application of surge voltage to the terminals of winding or induction of surge voltage to portions of a winding.

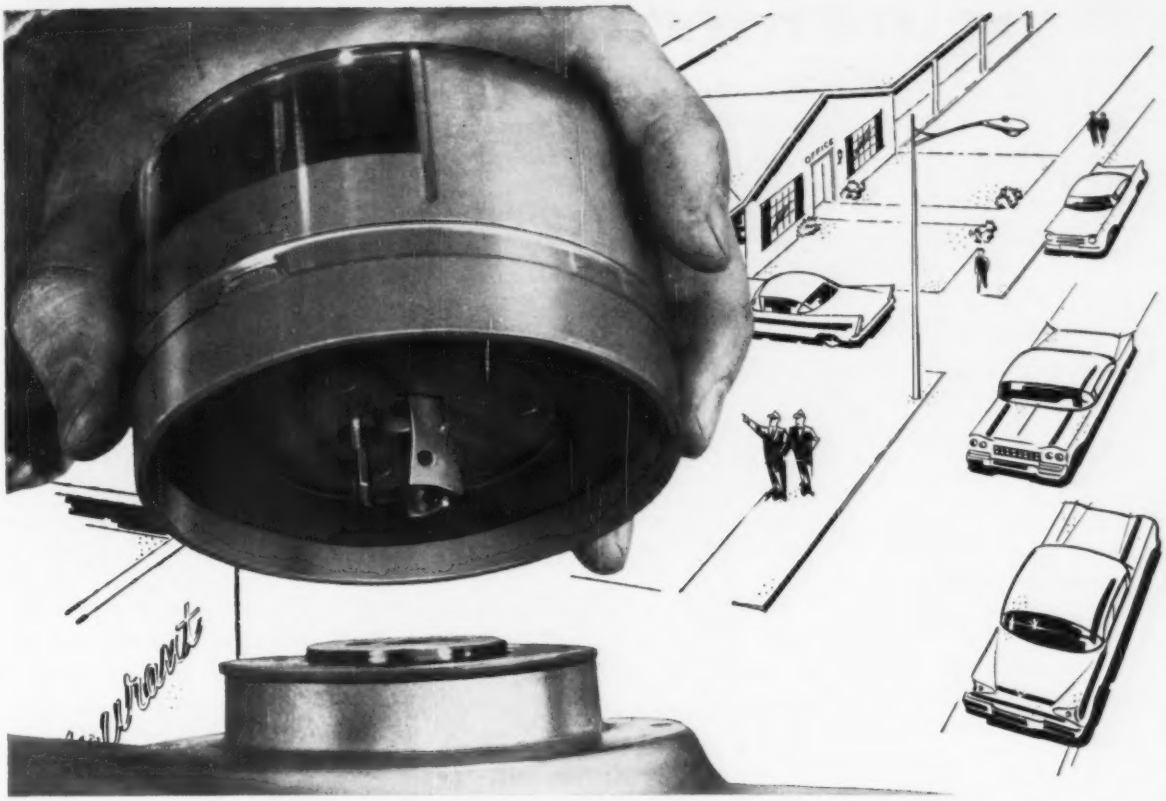
Recent progress in surge testing permits the application of any reasonable test voltage desired at much higher energy levels than previously possible. The equipment required is simple, portable, and well adapted to use in field application.

Slot Discharge and Corona Problems

On high-voltage stator windings, problems occasionally occur which involve either surface discharging in the slots or corona effects in the end windings. Corona probe tests are sometimes made, but experience has shown that the effects of unusual corona conditions in end windings are apparent from visual examination.

Discharge conditions in the slot are not generally obvious from a visual examination. However, test equipment is available which detects surface discharging due to loss of electrical contact between stator coil surfaces and the core.

Such internal void ionization can limit the life of high-voltage machine insulations. Although modern insulations rarely suffer in this respect, such conditions are most difficult to detect and isolate until deterioration progresses to the failure point.



Reliable—after years of tests

New G-E cadmium-sulphide control installs in seconds . . . lasts for years

Now, from General Electric comes the industry's newest, most dependable cadmium-sulphide photoelectric control. Years have been spent in the research, design, and testing of this new street lighting control to produce the most efficient, most reliable cadmium-sulphide control available. Now, after exhaustive testing, the reliability problem has been solved with a custom-built General Electric cadmium-sulphide cell. Shock, surge, humidity, vibration, load, temperature—these were among the tests conducted —but none was found to alter the dependable performance of the new G-E control.

Addition of the new cadmium-sulphide cell is but part of the story. General Electric has developed a new, simplified circuit with specially-engineered long-life components . . . designed and built to work together and to reduce your control costs.

Get the full details from your General Electric Apparatus Sales Engineer or Agent, or write Section 450-25, General Electric Company, Schenectady, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ADVANCED DESIGN FEATURES give: (1) dependability from new G-E hermetically sealed cadmium-sulphide cell; (2) long life from specially-engineered components; (3) built-in protection from voltage surges; (4) power savings through accurate external adjustment. NO VACUUM TUBES OR RECTIFIERS.

Procurement & Products

PRICES ▶ **Electrical manufacturers continue battle against inflation** with new price reduction announcements in a number of fields.

Makers of power transformers will meet price trims initiated by General Electric Co. These price cuts, which were introduced with GE's new large transformer design changes, average 5%, and will bring savings of up to 20% on the larger ratings. Every power transformer manufacturer which could be reached told Electrical World they would meet the competition.

Price reduction of approximately 20% on primary power capacitors has been announced by Sangamo Electric Co, Springfield, Ill. This is being done, says Sangamo, to realign prices with manufacturing costs and to accentuate the economies of supplying reactive power with capacitors rather than generation.

S&C Electric Co trims prices as much as 20% in its 7.2 to 34.5-kv vertical-break and double-break outdoor, three-pole Alduti load interrupters by eliminating price premiums on these items of equipment. S&C President John Conrad explained the price reduction, saying, "Up until now, the user who wanted the operating advantages of load interrupters over conventional disconnects had to pay a premium. The user now can get load interrupter performance at no extra cost." The price reduction, said Conrad, is due entirely to redesign for high-volume production.

COAL CONTRACTS ▶ **Long-range coal contracts bring TVA low-cost fuel.** The government power agency has announced the award of contracts calling for 23,070,660 tons of coal for delivery over periods ranging from five to 15 years at a cost, f. o. b. mine, of $69,182,914. This averages $2.98 per ton. West Kentucky Coal Co received the lion's share of the tonnage commitment, and will undertake to supply TVA a total of 12,750,660 tons over a period of 15 years for $36,976,914.

The TVA purchases were divided among three coal producing fields as follows: West Kentucky, 17,350,660 tons at a commitment of $50,215,914; East Kentucky, 4,420,000 tons at a commitment of $13,702,000; and East Tennessee, 1,300,000 tons at a commitment of $5,265,000.

SALES CHANGE ▶ **The Okonite Co will assume responsibility for sales of Kennecott** Wire and Cable Division's products effective Nov. 1. In the past, most of these copper wire mill products were marketed through the Chase Brass & Copper Co sales force.

News of Manufacturers ..... page 94

New Equipment ..... page 98

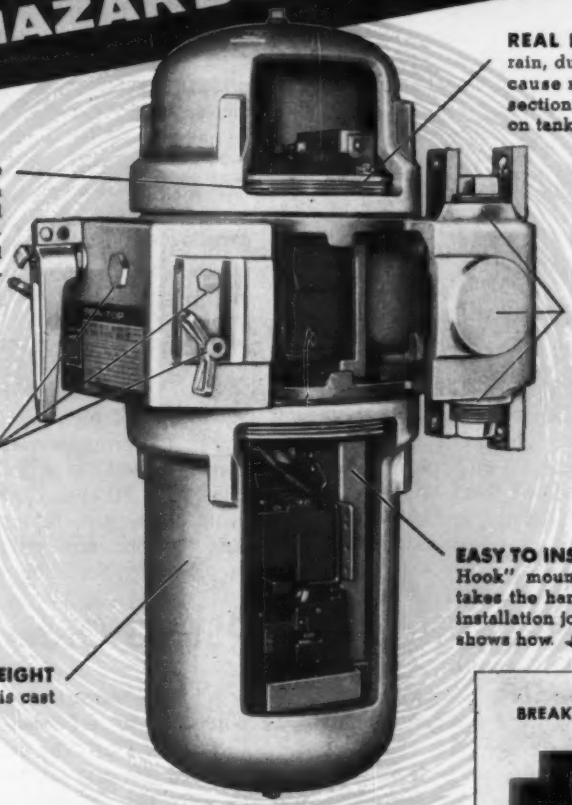
Readers Service ..... page 110

Square D announces...

NEW SPIN TOP ENCLOSURE FOR HAZARDOUS LOCATIONS

REAL PROTECTION against rain, dust, dirt and weather because male threads on collar section engage female threads on tank.

DAMAGE-RESISTING Acme thread. If you've struggled with "banged-up" threads, you'll appreciate this feature. It's always a breeze to put on and take off tanks for installation, inspection or maintenance.

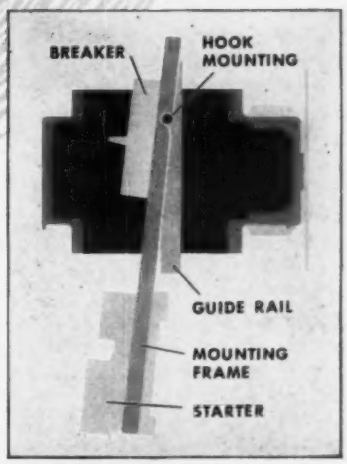


INCREASED WIRING SPACE and through-feed conduit entrances for horizontal tap-offs.

EASY TO ADD pushbuttons or selector switches with easy-to-buy, easy-to-use "off-the-shelf" parts kits.

EASY TO INSTALL • "Slide and Hook" mounting arrangement takes the hard work out of the installation job. Diagram below shows how.

STRONG and LIGHTWEIGHT The complete enclosure is cast aluminum.



SLIDE and HOOK MOUNTING

4 SIZES FOR STARTERS SIZE 0 THROUGH 5

CLASS I, GROUP C and D • CLASS II, GROUP E, F, and G

The new **SPIN TOP** enclosure is available from your Square D Distributor in three ways—complete device, enclosure only, or components only...for reversing and non-reversing across-the-line starters and combination starters. And for combination and non-combination two-speed starters.

Write **FOR BULLETIN 9990**

Square D Company, 4041 North Richards St., Milwaukee 12, Wis.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

Westinghouse Maps Low-Cost A-Program

Westinghouse has launched a campaign to provide the nation's utilities with the early means for developing economical nuclear power. The effort surrounds a three-point package now being described in detail to utility management and engineers.

Westinghouse is offering a warranty on overall plant costs, fuel burnup, and plant output on two big light-water plants now deemed ready for commercial construction. The third plant is a prototype of a highly-promising light-water type.

One of the plants proposed is a 330-net eMw "closed cycle" (pressurized water) plant, closely similar to that described in EW, June 22, 1959, p 68. It would produce power at 7.3 mills per net kwhr, figured on ground rules of 12.5% carrying charges, 90% plant factor, and $12 per gm plutonium buyback. If work begins soon, it could roll by late 1964.

The other big plant is a 215-net eMw "combination" plant, consisting of a forced circulation "direct cycle" (boiling water) reactor to supply 60% of the heat and a fossil fuel-fired superheater/reheater to provide 40%. This plant would produce at 7.3 mills per kwhr, based on the same ground rules and fossil fuel at 30¢ per million Btu. It could be in service in four years.

With an eye to the future, Westinghouse also proposes early prototype construction of an integral boiling and superheat reactor, dubbed IBSHR. This 20-net eMw pressure-tube "direct cycle" plant would cost $17 million plus $11.3 million R&D. Westinghouse believes this type, though not now competitive, promises the best future economy. If prototype work starts early, a full-scale plant could be in service by 1975.

Decision to concentrate commercial efforts on the two big light-water plants came after a "multi-front" study in conjunction with leading architect-engineers, according to Westinghouse. The study proved to the company's satisfaction the superiority of light-water plants, relegating other types to a "wait and see" status, commercially speaking. Westinghouse will continue development work on many of these other types, however.

The studies further proved that the two plants of the sizes chosen were economically the most promising at this time. Actual preliminary engineering has been completed on both.

Power cost breakdowns for the two plants are, in mills per net kwhr:

	330-Mw Closed Cycle	215-Mw Combination
Fixed charges	3.3	3.4
Fuel costs	3.0	2.7
Oper & Maint	0.5	0.7
Indirects	0.5	0.5
	7.3	7.3

"Indirects" include land (not included in fixed charges), interest during construction, and utility overheads. The figures for the "combination" plant assume firing of 30¢ per million Btu oil to the superheater/reheater.

Westinghouse is understood ready either to accept prime contractual responsibility or only to supply nuclear system, turbine-generator and condenser, and electrical apparatus.

The warranties would be worked out for the individual case, and would cover those items for which Westinghouse would be responsible.

Philosophy behind the "closed cycle" plant, say Westinghouse engineers, is that there is economy in large reactors, and that this type is the most-proven to date. Study over a 5- to 400-Mw range showed power costs dropping with size until a sharp leveling at 330 net eMw, the point at which largest single-shaft turbine for 650-psia dry and saturated steam is reached.

The "combination" plant takes advantage of the efficiencies of high-pressure superheated and reheated steam, and provides a new low for heat rates of atomic plants—9,040 Btu per net kwhr. It would use a modern 225-Mw, 1,800-psi, 1,000F/1,000F turbine. Fossil fuel firing of the superheater/reheater was chosen to sidestep the presently prohibitive economics of nuclear superheating, according to Westinghouse.

PSE&G Orders Computer

A fully transistorized digital computer has been purchased from Leeds & Northrup by Public Service Electric & Gas. The new LN 3000 computer will be installed late next summer at Bergen Generating Station to serve two 290-Mw steam turbine-generators.

A joint development of Leeds & Northrup and Philco, the new computer is believed the first to be used on a combined gas-and-coal fired installation. Public Service will use the equipment to do performance calculations now obtained manually, and to provide guides for the operator which have been impractical to compute until now, such as rates of temperature change.

Later on, the utility may use the computer to perform control functions in conjunction with L&N controls.

While exact amount of the contract was not disclosed, L&N says similar systems will cost approximately $250,000. Under their joint cooperative development program, Philco built the solid state computer while L&N developed and will manufacture the solid state input-output equipment and also will program the computer.

One of the two cross-compound Westinghouse units is already on the line at Bergen Station. The other is scheduled to roll late this year. (Electrical World, Nov. 12, 1956.)

(*More News of Manufacturers, p 96*)

QUALITY

CADWELD cable to lug electrical connections are superior to mechanical or soldered types.

Competitively priced, these quality connections are permanent and cannot loosen or corrode.

Simplified ordering—specify type connection and quantity only—equipment furnished automatically.

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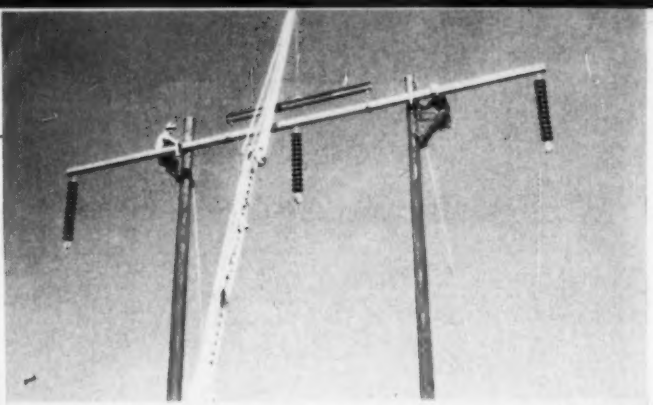
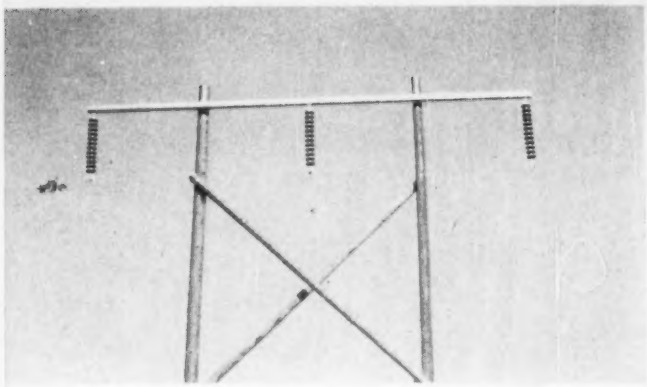
2070 E. 61st Place • Cleveland 3, Ohio





PGE Uses Tubular Aluminum for Crossarms on New Line

Portland General Electric has launched a pioneering development on a 230-kv power line being constructed near Salem, Ore., by using tubular aluminum crossarms on H-frame transmission towers (see two illustrations, left).

The experimental order placed by PGE with Aluminum Company of America was for 20 crossarms, including 41-ft tangent structure arms, and 36- and 25-ft angle structure arms. The arms were fabricated from extruded strong-alloy aluminum tube.

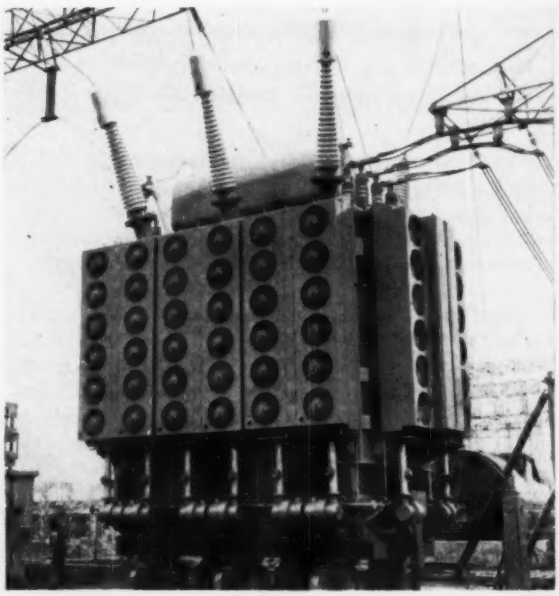
PGE states that extent of future applications of aluminum crossarms on its systems depends upon its experience with this initial installation. The experiment is being made as part of the utility's program to develop maintenance-free structures for its service area. By this move, PGE hopes to avoid costs of repainting.

PGE approved use of the tubular aluminum crossarms only after they had passed full-scale load tests made at its request at the physical testing station of Alcoa's Lafayette, Ind., works. The crossarms were designed by the structural department of Alcoa's development division; they were fabricated at the Lafayette extrusion plant.

MANUFACTURERS BRIEFS

General Electric's insulating materials department announces its new, five-year, multi-million dollar expansion program. Increased emphasis will be placed on outside sales of insulating materials, whereas up to now the department's efforts have been devoted principally to serving other GE components. Consolidation of the department's facilities in a new 32-acre location, acceleration of product development are planned . . . **Westinghouse** ships 3750-kva power transformer with sound level of only 41 decibels to Long Island Lighting. Low sound level, says company, was achieved largely through new technique of annealing steel, improved design, and use of sound absorbing panels . . . **Remington Rand** makes available the Univac Larc Solid State Computer which reportedly processes problems 25 to 200 times faster than other computers, can perform 250,000 additions or subtractions of 12-digit decimal numbers per second . . . **Alco Products** is building a steam generator for an 11.4 Mw nuclear power reactor at Piqua, Ohio . . . **Calavar Corp** delivers its third Big Brute (digger, pole setter) to Southern California Edison within a year . . . **Narda Ultrasonic Corp** has a new 10,000-sq-ft building in the New Cassel area of Westbury . . . **Electric Auto-Lite** enters the industrial battery market through the purchase of C&D Batteries, Inc, Conshohocken, Pa . . . **Du Pont** has developed a thermoplastic film of Teflon to be marketed late this year.

(*More Procurement & Products, p* 98)



Huge Japanese Unit Readied

This 275-kv, 312-Mva transformer (right), largest of its type in the Orient, is ready for installation at the Minami Kawagoe transformer substation near Tokyo. The $1.4 million unit weighs 500 tons, is 40x31x20 ft. It was built by Mitsubishi Electric.

STRIPSEAL

seals in oxide-inhibiting PENETROX®
...on the connector contact surfaces

No Cutting...No Snipping or Ripping...Just a Gentle Pull

TAPIT® with STRIPSEAL makes neat, clean aluminum-to-copper connections.

and your Burndy STRIPSEALED connector is ready to make a trouble-free aluminum connection. STRIPSEAL, the leak-proof, all-weather, plastic cover hugs the connector like a "cocoon"...seals in oxide-inhibiting PENETROX—on the contact surfaces, where it belongs. **It's easy to use**...even with work gloves on. **It's clean**...just dry brush conductor and install the connector; no on-the-job application of oxide inhibitor needed. **It's sure**...lineman can't forget PENETROX. For positive protection of every connection, specify Burndy connectors with STRIPSEAL. Write for full details.

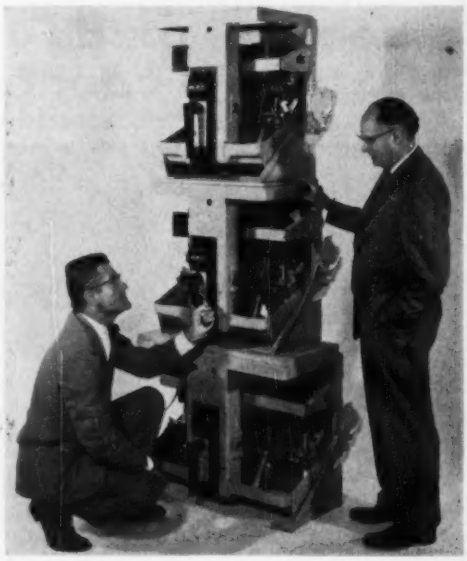
BURNDY

59-18

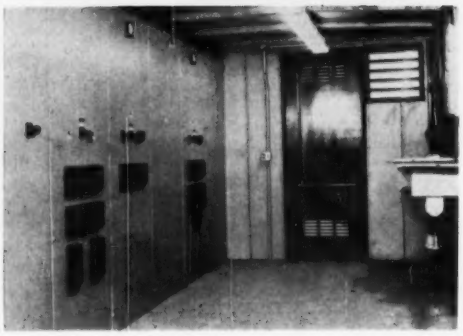
Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

(For further information refer to Readers Service on page 110)

Circuit Breakers . . .



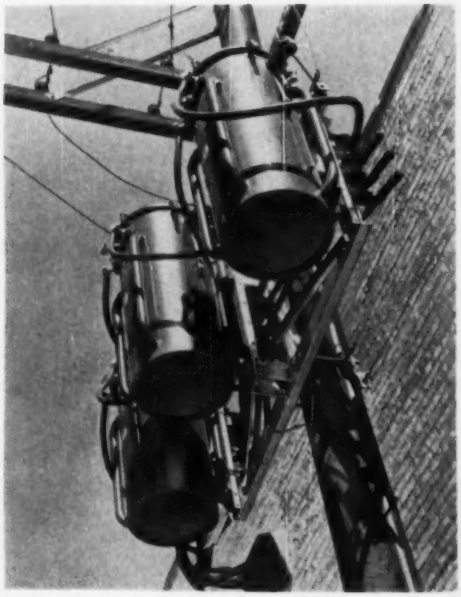
. . . for low-voltage installations are available in three new manually-operated sizes. Frame sizes are designated AK-2-50, 75 and 100 and are rated 1,600, 3,000 and 4,000 amp respectively, up to 600 v. All frame sizes of General Electric low voltage power circuit breakers can now be operated manually or electrically utilizing the stored energy principle. Maintenance features include individually spring-loaded contacts and elimination of flexible braids through use of a wrist pin to carry load current.
General Electric Co, Schenectady 5, N. Y.



Work Aisle . . .

. . . for 5 and 15-kv metal-clad switchgear provides safe and comfortable conditions for inspection and maintenance in all weather. The wide aisle offers ample space for breakers to be completely withdrawn, and enough space is available for two breakers to pass. There is also room enough for the installation of a small desk and for mounting a testing panel for breakers.
Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.

Transformer Mount . . .



. . . is designed for "in-line" mounting of three distribution transformers up to 75 kva. It is used chiefly on alley installations to provide climbing space between the pole and a building wall. The J25564 Mount is hot dip galvanized. Assembly of transformers, mount, and secondary bus can be made on the ground. The entire unit is hoisted up and banded to the wood pole.
Joslyn Mfg and Supply Co, 155 N Wacker Dr, Chicago 6, Ill.

(*More New Equipment on page* 102)

why choose THIS when you can have

THIS ?

* **PRESSURE-RELIEF CAP CUTOUT** photographed in action discharging the cap, fuse link button head, and ionized gases upward into the primary.

* **HUBBARD EHD FAULTMASTER CUTOUT** with exclusive Single-Vent Small-Bore action discharging all gases down and away in a single confined cone.

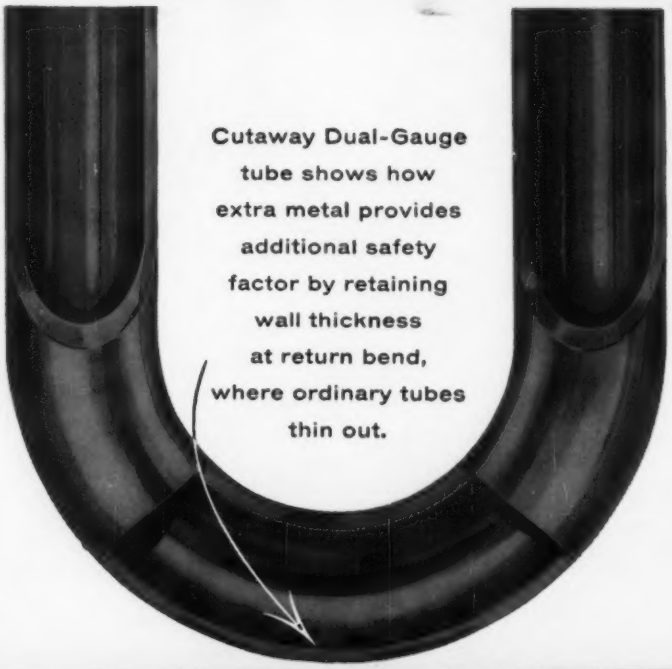
** Both photographs are open shutter exposures, taken of cutouts tested on a 15 kv circuit with 8000 amperes available.*

Manufactured in Canada by
N. Slater Co., Hamilton, Ontario

BETTER PRODUCTS *through Creative Engineering*

HUBBARD

AND COMPANY · 200 SOUTH MICHIGAN AVENUE · CHICAGO 4, ILLINOIS



Specify

DUAL-GAUGE

First for Lasting Quality—from Mine to Market!

To keep tubes uniformly strong
in condensers, feed water heaters,
heat exchangers and similar equipment...

PHELPS DODGE

TUBING!

Provides heavier wall thickness:

a. At one or more points in tube length to compensate for thinning on outer portions of return bends.

b. At points of support.

c. At tube ends to meet special requirements.

Produced in all standard sizes or manufactured to the particular design requirements of individual customers.

Available in Cupro-Nickel, Red Brass, Aluminum Brass, Admiralty metal and Muntz metal.

PHELPS DODGE COPPER PRODUCTS CORPORATION

PHELPS DODGE COPPER PRODUCTS
CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N. C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

One or Two Coats of Subox Give The Protection of Three of Ordinary Paint

As the only American paints made with *lead-suboxide*, Subox paints provide extraordinary protection to metal surfaces. Unlike inert pigments, *lead-suboxide* is chemically active. That means Subox works continuously to combat corrosion.

Two coats of Subox usually will give the protection of three of standard paint, and frequently but one coat is enough.

Even under severe conditions, Subox paints do not crack, chip or blister. Eventual repainting costs are cut to a minimum because *lead-suboxide* establishes a dense, metallic lead film which can be recoated without expensive scraping, sanding or repriming.

Anti-corrosive Subox paints are available in a wide selection of colors—dark and light.

Write for a copy of "Plan Painting of New Plants to Reduce Costs."

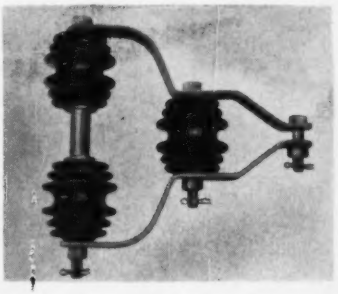
SUBOX PAINTS

Subox Inc.

Established 1924

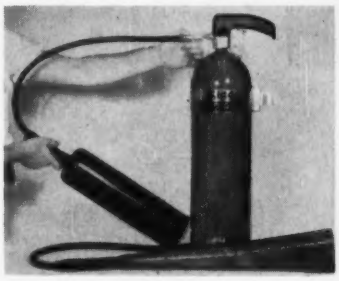
3 Fairmount Plant, Hackensack, N. J.

Subox Company of Canada, Weston, Toronto 15



Corner Support . . .

. . . **supports 3-conductor aerial cable** in a triangular configuration at corners. It is used when the corner angle exceeds 10 deg for large conductors or 25 deg for small conductors. It provides 7 in. of uniform air space between any two conductors and can be mounted either vertically or horizontally.
A. B. Chance Co, Centralia, Mo.



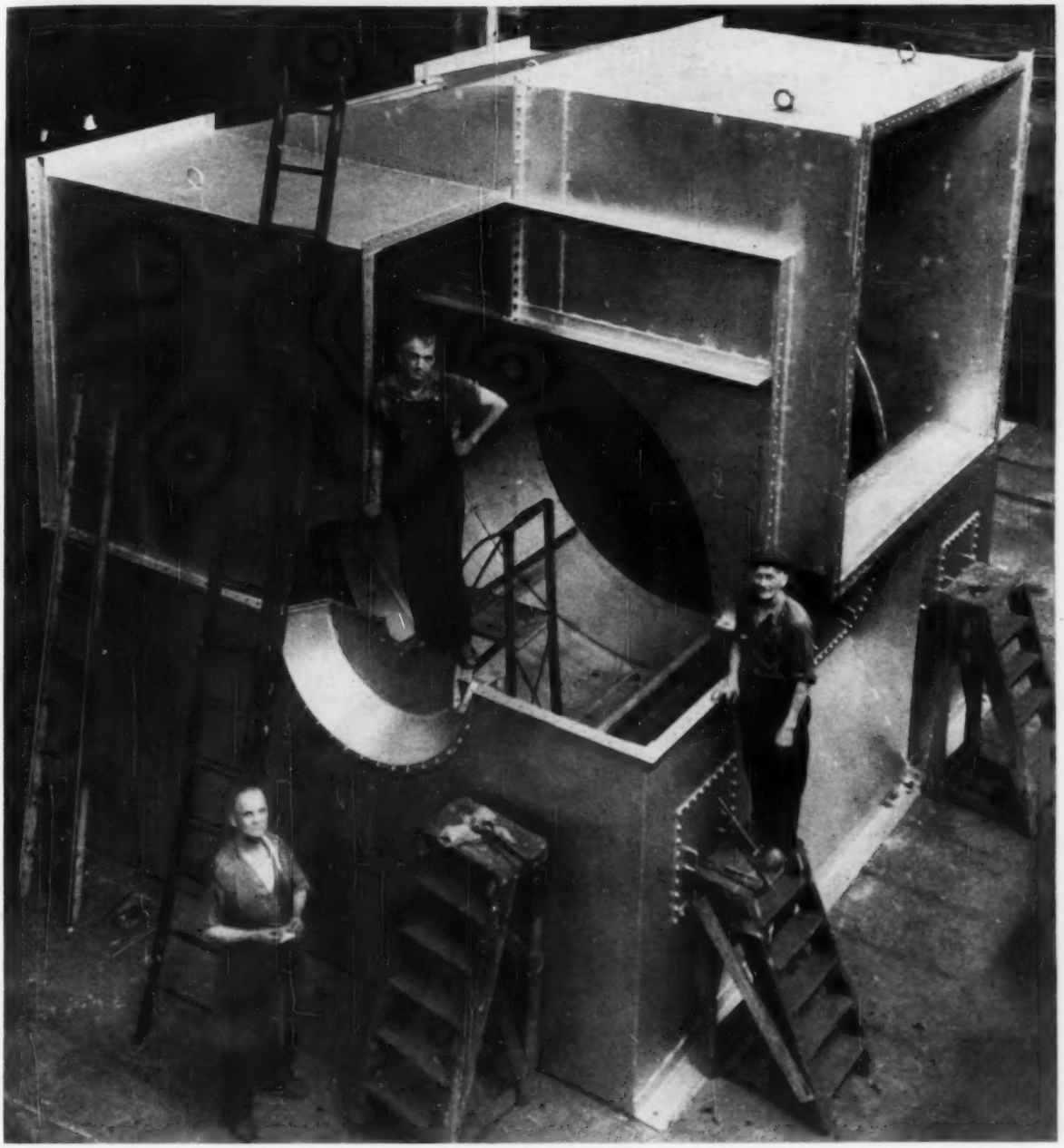
Fire Extinguisher . . .

. . . **replacement kit** will upgrade extinguishing ability of older portables. The hose and discharge horn assembly is offered for the company's 10, 15 and 20-lb carbon dioxide extinguishers now in the field. The new equipment will permit raising of the older units to Underwriters' Laboratories ratings of 8 B:C, 10 B:C and 12 B:C.
Walter Kidde & Co, Inc, Belleville, N. J.

Connector . . .

. . . **has stainless steel clips** that snap on to the main conductor and hold the connector in place while a tap is made. This provides fast, safe installation and permits "hot" as well as "cold" installations. Known

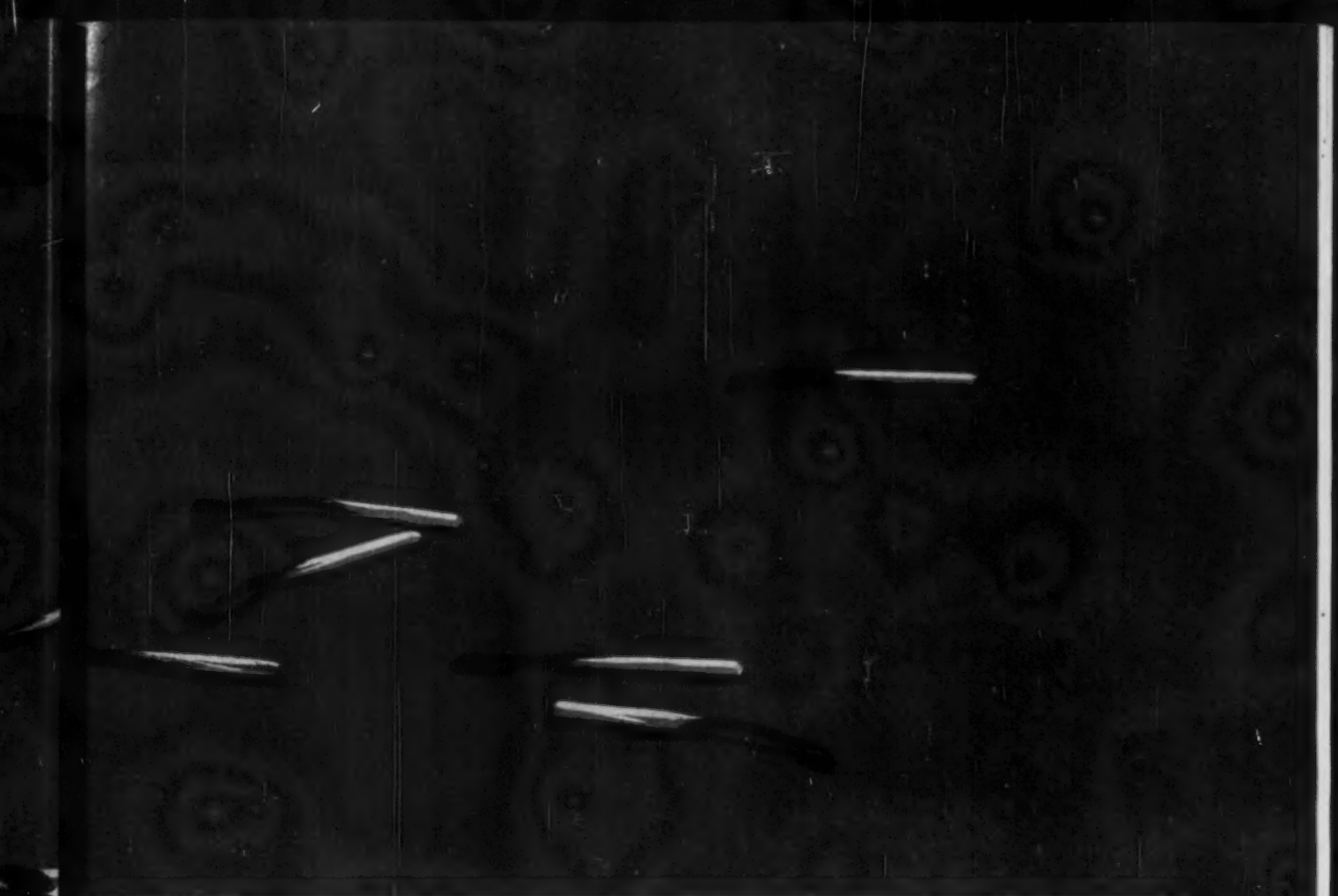
(*Continued on page* 106)



You wouldn't buy a bargain basement parachute... or a cut-rate big game rifle...

Don't choose less than Clarage quality for your mechanical draft service. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Clarage, a specialist in building forced and induced draft fans, offers you equipment having a long-standing reputation for long-lasting service. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

The Continuing Search For Economical Energy



Now—Btu's from coal that "Can't Be Burned"

Utilities who thought it couldn't be done, are now burning low-cost, low-grade, high-ash coal—helping to keep kilowatts America's biggest bargain.

The reason? B&W fuel research that led to the design of the Cyclone Furnace. Fact is, the B&W Cyclone Furnace was *designed* to burn the really "tough" coals—and squeeze the maximum Btu's from every pound.

Behind the Cyclone's success are more than 33,000 B&W fuel analyses. With this tremendous background and experience, B&W can build fuel burning equipment around the fuel *you'll* burn. It means you can utilize available low-cost fuels you could never use before.

Important to you, too, is B&W's complete objectivity in making recommendations. For B&W manufactures all types of fuel burning equipment—for every application. Why not discuss your special requirements with us now. Write to The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

G909-CS

LABORATORY CONTROLLED...

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

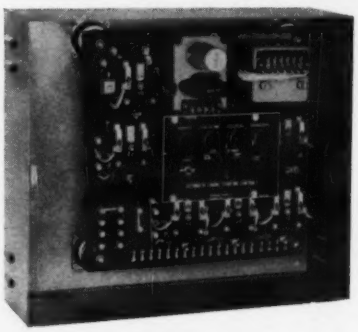
STEEL & WIRE CO., INC., Muncie, Indiana

Connector . . .

(*Continued from page* 102)

as Series CPT, the connector is shaped in a one-piece figure "6" design and is adaptable for either "L" or stirrup taps. CPT connectors are available in sizes to cover cable ranges from No. 6 solid to 4/0 ACSR.

Anderson Electric Co, Birmingham, Ala.



Starting Switch . . .

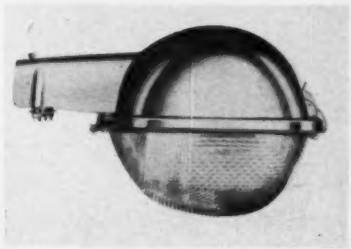
. . . provides fully automatic starting and stopping of engine driven generating sets. The Automatic Engine Starting Control prevents recranking at full engine speed. It is designed to respond at 50% of normal battery voltage, and it operates over a broad ambient temperature range.

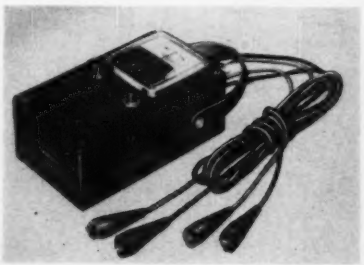
Automatic Switch Co, Florham Park, N. J.

Luminaire . . .

. . . is designed for streets, highways and other high-level lighting areas. It is equipped with a fixed mogul socket for multiple service and accommodates lamps rated at 250, 400 or 425 w. Known as Line 2Al, it has a heavy gauge aluminum housing that also serves as a reflector.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.





Tester . . .

. . . checks correctness of polarity markings on transformers. Known as Catalog No. 865, it can be used on small instrument transformers as well as large power transformers. A small dry cell operates the checker.

Eastern Specialty Co, 3617 N Eighth St, Philadelphia 40, Pa.

Power Cable . . .

. . . for 28-kv operation has 33/64-in. butyl-rubber insulation. It is most commonly used as primary lead cable for generators, transformers and other distribution equipment. In addition to its heavy insulation the cable has a 7/64-in. neoprene outer jacket. It has an outside diameter of 2.3 in. and weighs 3.6 lb per ft.

National Electric Div, H. K. Porter Co, Inc, Pittsburgh 19, Pa.

Keep Hot Sticks

DRY SAFE HANDY

... tote 'em right to the job in the new Chance Heavy-Duty Tool Trailer. It keeps tools off the ground ... dry, ready, and safe to use when you need them. It's weatherproof, of course.

Check the improvements. We've widened the body and replaced fenders with wheel wells. There are four padded racks (instead of three), and they'll hold long and short platforms as well as tools. The racks are farther apart, too; there's more room for rope and cover-up equipment. And, there are more bins for small tools.

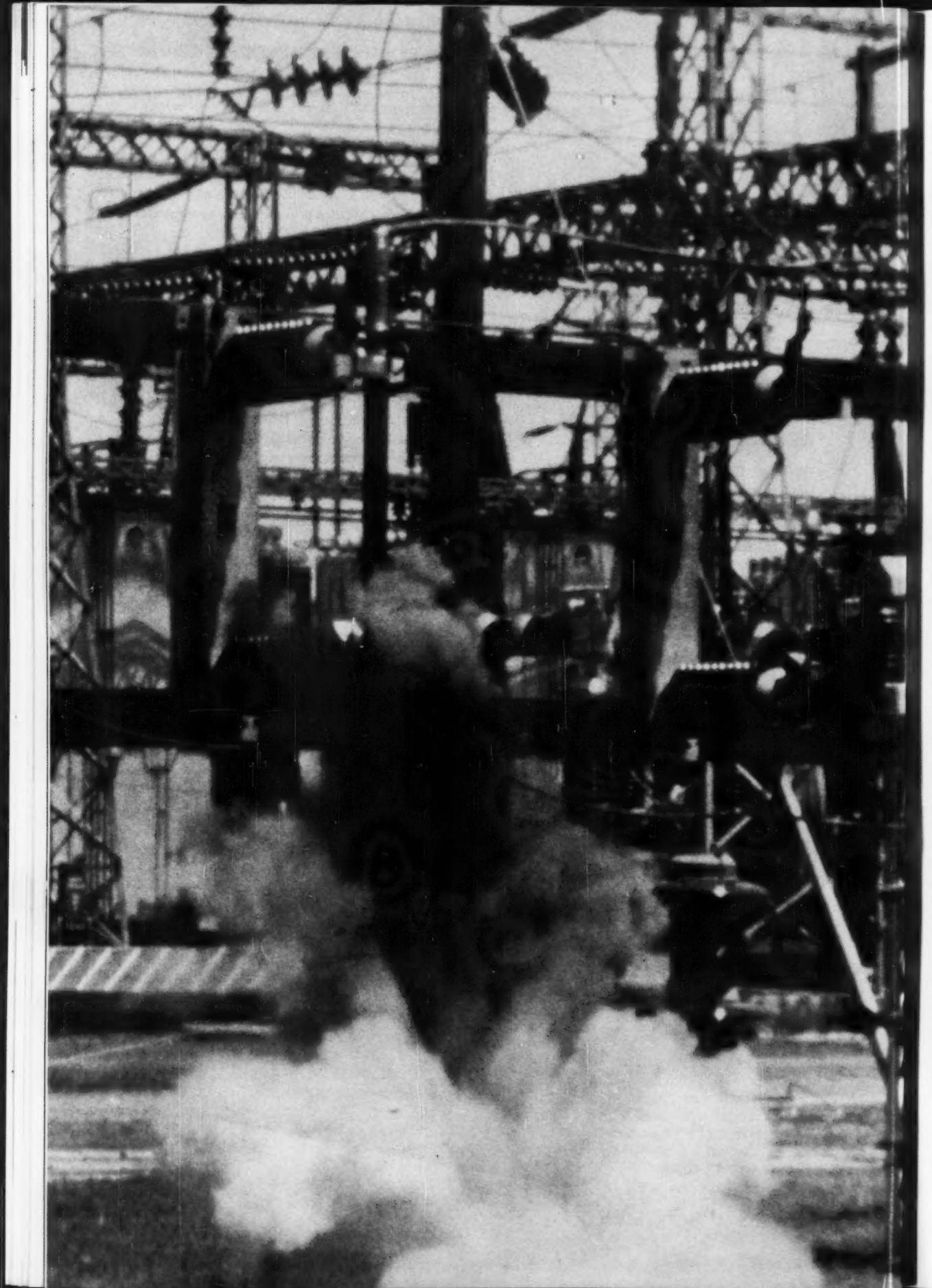
Up front, there is a new pintleye hitch which is easily adapted to the pintle hooks on your heavy line trucks. The hitch can be adjusted vertically to line up with the hook, and horizontally to give proper clearance from the truck.

Next, look at some of the good things we haven't changed. The familiar counter-balanced top is there. It, plus the trailer's low chassis and convenient rack arrangement, makes it easy to remove and replace tools in seconds. And, you'll still find an electric heater and circulating fan in every Chance Heavy-Duty trailer. Plugged into an outside circuit when the trailer is not in the field, they work to keep tools bone dry, eliminate the need for special tool-drying racks.

Sound good? It is, and there's more to be told. So, write us ... we'll send you complete information, specifications, and prices by return mail.

A. B. CHANCE COMPANY
General Offices: Centralia, Mo.
A. B. Chance Co. of Canada, Ltd., Toronto

CH59-26



Here is a 1,900,000 kva test shot on an S&C power fuse

...But what does it prove?

Absolutely nothing... without (1)

COMPLETE INSTRUMENTATION and TEST DATA—such as the quantitative record (shown at left) of this short circuit test shot.

TEST DATA

Data on Test Circuit	
* Normal frequency, cycles/second	60
Bus voltage, phase-to-phase, volts, rms	38,100
Bus voltage, phase-to-ground, volts, rms	22,000
* Power Factor	Less than 12%
Available Fault, computed	
Kva, three-phase, symmetrical	1,900,000
Amperes, rms, asymmetrical	46,500
Amperes, rms, symmetrical	29,200
Data Taken During Line-to-Ground Test	
From Magnetic Oscillograms	
* Normal frequency, cycles/second	60
Bus voltage (normal frequency), volts, rms	38,100
* Recovery voltage across fuse (normal frequency), volts, rms	22,000
* Current through fuse, amperes, rms asymmetrical	42,300
Arcing time, cycles	0.8
* Total clearing time, cycles	0.8
Arc energy, watt-sec.	383,000
Arc power, peak, watts	110,000,000
From Cathode Ray Oscillograms	
Natural frequency, cycles/second	19,000
Recovery voltage, across fuse	
(Normal frequency) volts, peak	31,000
(Natural frequency) volts, peak	32,000
Rate of rise, volts per μsec ($4E_{p\text{-}p}$ f x 10^{-6})	2,430

*Required by AIEE and NEMA testing standards

without (2)

SKILLFUL ANALYSIS. Even when the fuse clears, the test data have to be critically examined. For example, could this apparently successful test shot have been just a lucky—or easy—break? Was the natural frequency of the circuit unrealistically low? Was the rate of rise and/or the amplitude of recovery voltage across the fuse high enough? Does the arc energy developed suggest marginal operation? These questions are tough to answer for anyone but a fuse expert. They aren't covered in NEMA or AIEE short circuit test standards.

without (3)

MULTIPLE SHOTS. For a given test condition, numerous shots must be made to factor the variables of fuse ampere rating, manufacturing tolerances, and minor differences in construction.

without (4)

A VAST TESTING COMPLEX. One test (let alone one *shot*) is no basis for proving out a fuse. It has to be integrated with other tests amassed over the years in the field and in the laboratory, in order to substantiate the published interrupting ratings at all voltages, for all circuit parameters, at all fault levels.

This kind of electrical testing is essential for the performance integrity of a high voltage power fuse. Expensive, yes! But you'll find it anyway behind S&C's type SMD Power Fuse. You won't find it behind the bargain varieties which use ballistics as a substitute for electrical testing.

The reproduction from test film (left) and the test record (above) cover one of 19 shots on one type of SMD Power Fuse on one voltage rating (34.5 kv), at two high fault levels on just one day of testing.

Oh, by the way, all that the 19 shots proved was that the SMD is satisfactory for very high (and tough) phase-to-ground faults on a 34.5 kv system. That's all S&C got from a single day's testing! It's simply a small part of the 20-year testing complex which backs up the SMD's ratings.

S&C ELECTRIC COMPANY

4421 Ravenswood Avenue, Chicago 40, Ill.

S&C

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

GE ..... Breakers ☐
Federal Pacific ..... Work Aisle ☐
Joslyn ..... Rack ☐
Chance ..... Support ☐
Kidde ..... Fire Extinguisher ☐
Anderson ..... Connector ☐
Automatic Switch ..... Switch ☐
Line Material ..... Luminaire ☐
Eastern Specialty ..... Tester ☐
H. K. Porter ..... Cable ☐

OTHER

_____

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* **Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.**

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TITLE _____
DEPT. _____
COMPANY _____
ADDRESS _____
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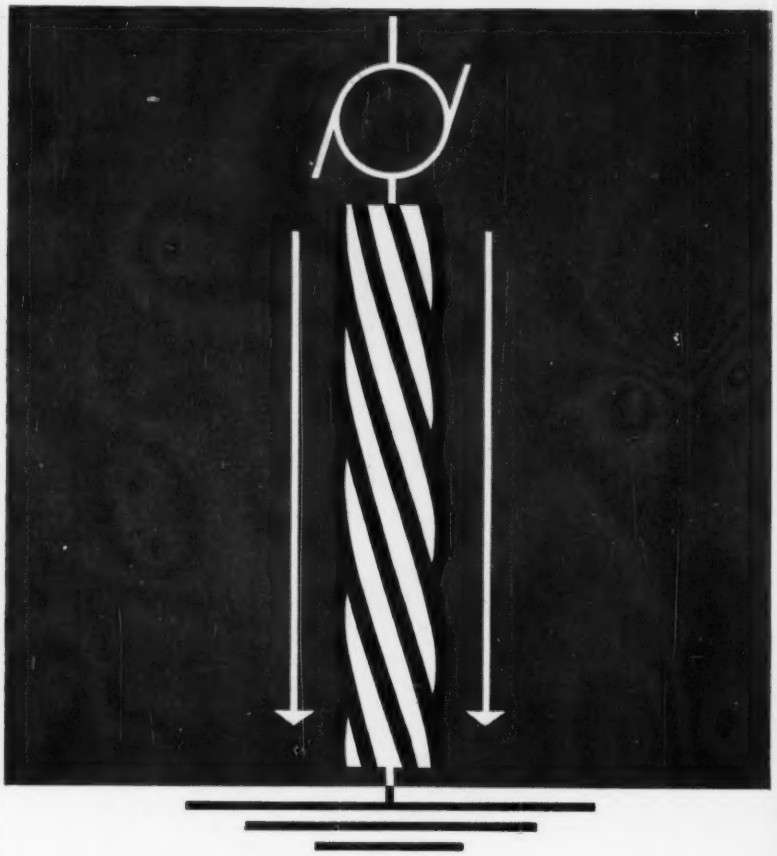
FOR:

Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

OCTOBER 5, 1959



It's safe... it's grounded with

CF&I Galvanized Steel Strand

When grounding electrical installations, you can't afford to use "second best" wire. Insist on a dependable steel strand that will give years of trouble-free service — CF&I Galvanized Steel Strand. Woven in seven- or three-wire constructions, CF&I Galvanized Steel Strand is made in accordance with ASTM Specification A-363 zinc coated steel Overhead Ground-Wire Strand.

For guy, messenger and other applications we recommend ASTM Specification A-122. *CF&I is also prepared to produce uniformly galvanized strand to your own specifications.*

Remember . . . for quick delivery and complete information, call the nearby CF&I sales office or your local electrical distributor.

GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

In the West: **THE COLORADO FUEL AND IRON CORPORATION** — Albuquerque · Amarillo · Billings · Boise Butte · Denver · El Paso · Farmington (N. M.) · Ft. Worth · Houston Kansas City · Lincoln · Los Angeles · Oakland · Oklahoma City Phoenix · Portland · Pueblo · Salt Lake City · San Francisco San Leandro · Seattle · Spokane · Wichita

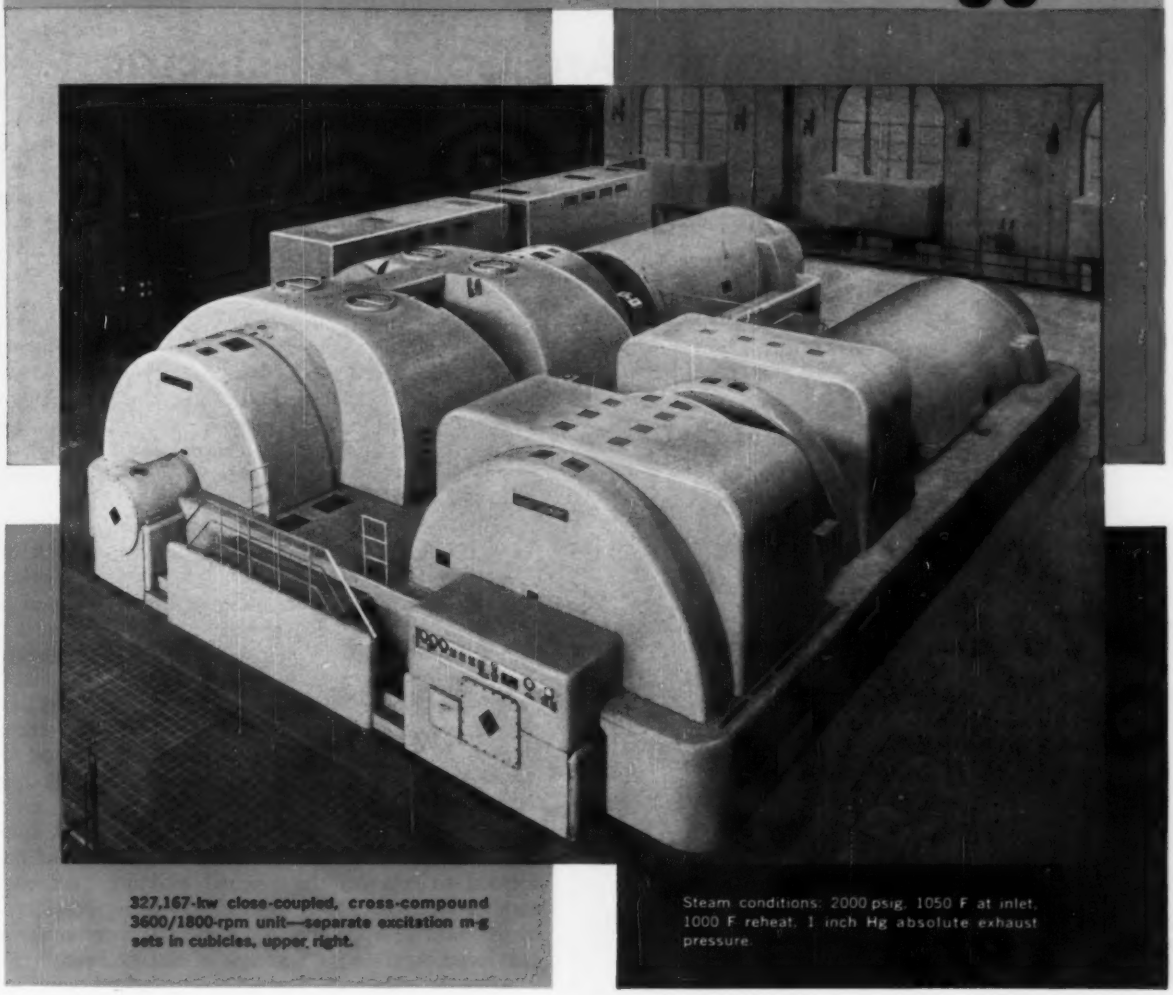
In the East: **WICKWIRE SPENCER STEEL DIVISION** — Atlanta · Boston Buffalo · Chicago · Detroit · New Orleans · New York · Philadelphia

CF&I OFFICE IN CANADA: Montreal

CANADIAN REPRESENTATIVES AT: Calgary · Edmonton · Vancouver · Winnipeg

6960

ALLIS-CHALMERS modern line for '59



327,167-kw close-coupled, cross-compound 3600/1800-rpm unit—separate excitation m-g sets in cubicles, upper right.

Steam conditions: 2000 psig, 1050 F at inlet, 1000 F reheat, 1 inch Hg absolute exhaust pressure.

Commonwealth Edison's new
327,167-kw Fisk 19 doubles station output

This steam turbine generator, the second of several such Allis-Chalmers units to go into service, is equipped with record 46-inch long exhaust blades. The unit's 200,000-sq-ft Allis-Chalmers condenser, too, is of world-record size.

Notable among today's generation achievements, Fisk 19 employs close-coupling with short crossunders, a ring-type nozzle chest, side-mounted turning gears, a double-flow intermediate pressure turbine and a fully supercharged 3600-rpm generator.

To learn more about these and other design features of Allis-Chalmers tandem and cross-compound units, see your nearby A-C office or write to Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS A-C

A-1154-E

Big or Small, Homes Are Going All-Electric

- **150-yr-old cabin, rustic outside, is modern inside with electric heat and appliances**
- **122-yr-old Gold Medallion mansion has heat pump and resistance heating**

Whether a palace or a "pad," any type of residence can be all-electric.

This was proved recently by Appalachian Power Co when they sold the idea of electric heat and electric appliances for a 150-year-old cabin, and helped convert a 122-year-old mansion for all-electric living.

The cabin, used as a weekend home by a Bluefield, West Va., doctor, was converted to electric heat on the advice of Archie G. Phlegar, area sales representative in the Bluefield district of Applachian Power. After the cabin was insulated to specification, 19.5-kw of radiant electric heat was installed. Then an electric deep well pump, water heater, range, automatic laundry, dishwasher and outside flood lighting were added.

THIS CABIN is a weekend home for a doctor who believes in living better electrically. Electric heating is featured

VIRGINIA MANSION has a 6,160-sq-ft main house and a 1,750-sq-ft addition, both with electric heat and appliances

On the other hand, a three-story mansion with 6,160 sq ft of floor space plus a new 1,750-sq-ft addition, is now all-electric. The house, owned by J. E. Covington of Henry County, Va., has a total load of 243 kw and the capacity is rated at 1,000 amp. The two sections are metered separately, and the house is served from an underground transformer vault adjacent to the basement wall. This vault is connected to Appalachian's distribution system by underground cables.

Representatives of the Fieldale, Va., district of Applachian Power, under the supervision of Jack M. Burnett, commercial manager, approached the Covingtons on total use of electricity when they decided to build the addition. Equipment installed included a heat pump with 27 kw in auxiliary resistance heating, 24 kw in built-in ovens and range surface units, a 4-kw water heater, a 5-kw laundry, and 5 kw lighting. Miscellaneous electric and electronic equipment, amounting to 4 kw, was also added. The total load for this section, which qualifies for a Gold Medallion, is 75 kw.

When the new living area was half completed, company representatives learned that the Covingtons had decided to remodel the original building. Although another type of heating system was being considered by the owners, Appalachian commercial representatives convinced them on the wiseness of electric heat.

After the old plaster had been stripped off walls and ceilings, adequate insulation and 73 kw in ceiling cable and baseboard heating units were installed. In addition, there is now 23 kw of water heating, 12 kw cooking, 8 kw lighting, 5 kw laundry, and 4 kw in miscellaneous equipment. Wiring has been installed for 15 tons of air conditioning.

The Covingtons' next move was to modernize the outdoor recreation facilities on the estate. These facilities include a swimming pool, tennis court, and summer cottage and are served by a 200-amp circuit from the old section of the mansion. The recreation center load now consists of 12 kw of lighting at the tennis court, 6 kw water heating and 19 kw baseboard heating in the cottage.

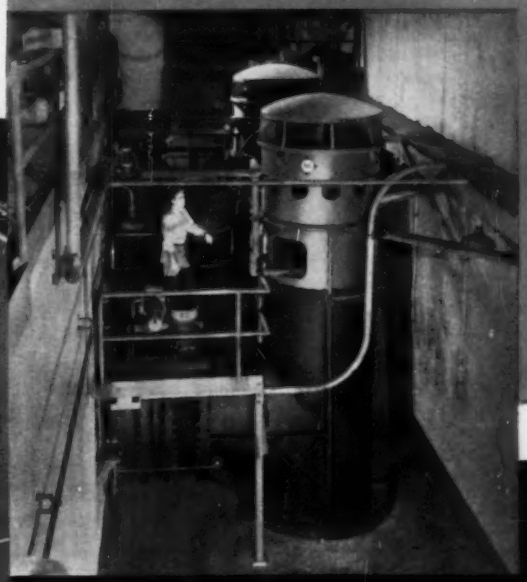
Another interesting feature is that to provide hot water for all uses nine QR-40 water heaters were installed, most of them near bathrooms. This installation plan has cut down on long draw-offs of water.

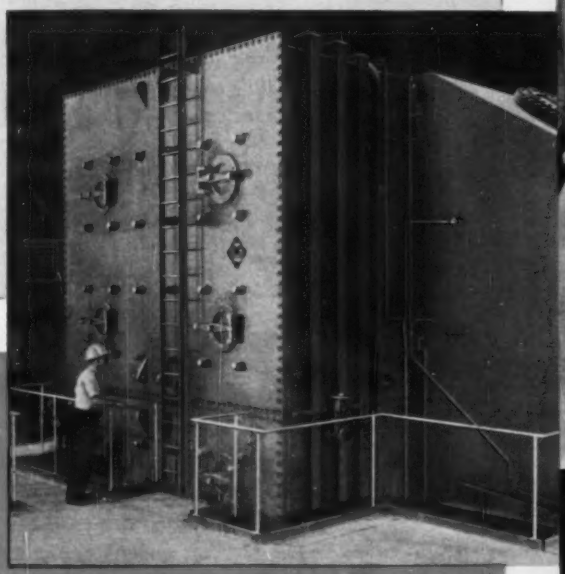
The Covingtons, who lived in Shanghai, China, at one time, find there's no place like home, especially when it's all-electric.

(*More Selling on p* 114)

ALLIS-CHALMERS modern line for '59

Planned-as-a-package auxiliary — two A-C vertical mixed-flow pumps serving a condenser at a midwestern power plant.





Planned-as-a-package condenser—a side inlet 130,000-sq-ft, two-pass surface condenser.

Complete CONDENSER auxiliary equipment planned as a package

. . . and mated to your project to gain peak system efficiency

Here's how A-C engineers maintain the higher degree of operating efficiency created by "guided-flow" condenser design. They select from a complete line of circulating and condensate pumps, motors, air ejectors and rotary vacuum pumps, then application-engineer these auxiliaries into an integral condenser package. All system components serve the condenser in achieving highest possible vacuum, maximum condensate temperature with a minimum of dissolved oxygen.

And in every size — from 100 to 200,000 sq ft and larger — you benefit from Allis-Chalmers pioneered *rectangular* condenser shape that makes possible a more compact, space-saving installation.

For complete condenser help — from design through erection — see your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS A-C A-1162-E

LET'S TALK ABOUT STRAND...

Aluminized STRAND

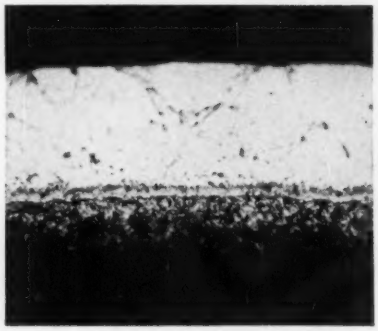
ACCO *Aluminized* steel strand is composed of steel wires which have an adherent, ductile aluminum coating applied by the hot dip method. The result—strand with all the strength of steel, and with the corrosion-resistance of aluminum. Also, you get these important advantages:

Aluminum oxide protection—Aluminum, when exposed to the atmosphere, has a film of aluminum oxide formed over it. This film, though thin, is impervious to corrosive atmospheres, provides extra protection in the most severe service.

Electrochemical protection—Should nicks or cuts pierce the aluminum coating, the corrosion-resistance will be retained by an electrochemical "healing" process.

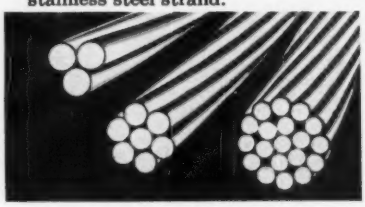
Salt spray tests, conducted according to ASTM procedures, show that with equal thicknesses of coating, *aluminized outlasts galvanized by more than 2 to 1.* Available for guy wire, ground wire and messenger wire applications, Page ACCO Aluminized steel strand is offered in Common, Siemens-Martin, High Strength, Extra High Strength and Utility grades with physical properties conforming to ASTM Spec. A-122-54T and A-363-58.

Page also makes galvanized and stainless steel strand.



500X magnification above shows thin aluminum-iron alloy resulting from diffusion of the two metals, and the outer layer of aluminum in the form of a fine-grain cast structure.

5-year test exposure to industrial atmospheres covered strand with coating of sulfide, oxide and soot. Scrubbing with soap and water showed aluminum coating completely unaffected.



Page ACCO Aluminized steel strand is available with 3, 7 and 19-wire construction.

WRITE FOR DETAILS.

Booklet DH-537 explains manufacture, properties and uses of Page ACCO Aluminized Steel Strand. Write us at Monessen, Pa., for your copy.

PAGE MANUFACTURERS WIRE

ACCO

Page Steel and Wire Division
American Chain & Cable Company, Inc.
Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore. San Francisco, Bridgeport, Conn.

OTHER ACCO ALUMINIZED STEEL WIRES

Aluminized ACSR core wire now available from leading manufacturers of aluminized conductor cable.

Page Chain Link Fence of ACCO Aluminized wire provides economical, longer-lasting protection.

Tie wire, telephone and telegraph wire, lashing wire, barbed wire, and other products are also available in Page ACCO Aluminized wire.

Ask us for details.

PAGE *-the source for answers to wire problems*

Bubble Houses Tested In Northwest

Washington Water Power Co, in cooperation with the Washington Farm Electrification Committee at Washington State College, has been experimenting with a new application for farm use—plastic bubble houses.

The bubble houses are held up by air pressure on the inside just like a balloon. A ⅓-hp motor supplies all the needed air and the opening or closing of the door has little or no effect.

According to Don Jordin, WWP agricultural engineer, and Walt Mason, project director for the WFEC, the houses cost as little as 6¢ per sq ft of ground space. They can be used as hothouses, greenhouses, weathertight storage areas for farm machinery, swimming pool covers and dozens of other special jobs. Electric heaters can be used inside.

"Using a bubble house like this," Jordin says, "a truck farmer could grow vegetables the year around at a very low cost. They appear to be feasible for raising such things as peppers, tomatoes, radishes, lettuce, green onions and bedding plans. One local grower has estimated that 700 dozen bunches of radishes could be raised in a 16 x 38-ft bubble house every 23 days during winter months, for a gross return of about $350.

The WEFC studies are financed by WWP, Puget Sound Power & Light Co, and Pacific Power & Light Co, with actual research programs under the direction of the department of agricultural engineering at WSC.

New Light Bulb

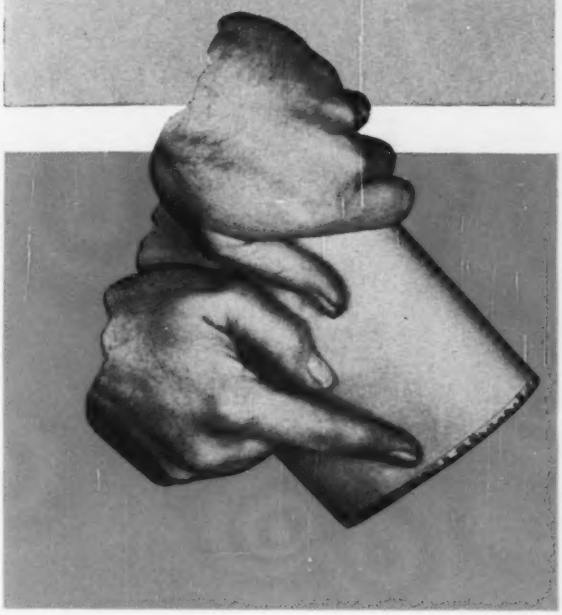
An entirely new 3-way light bulb has been developed by Westinghouse Electric Corp. Cylindrical in shape, the 50-100-150-w bulb has an improved 50-w minor filament, according to the manufacturer. The new lamp provides a 7% increase in light output at each wattage as the result of a new coiled-coil filament used in the new bulb, Westinghouse says.

(*More Selling on p* 116)

ALLIS-CHALMERS modern line for '59

EXTENDED-FOIL COOLING...

- reduces hot-spot temperatures
- lengthens service life



New Allis-Chalmers Power-Factor Capacitors

Allis-Chalmers extends aluminum foil *beyond* the ends of each capacitor pack to speed heat dissipation to container sides. Result: *substantial reduction* in hot-spot temperature over ordinary capacitor designs!

And electrical contact is also improved. Broad spring-pressure contact plates press against the long edges of each foil. Losses are minimized; low current density results. Your bonus: extra years of faithful capacitor life . . . extra protection against transient overcurrent induced by lightning, switching surges or capacitor-discharge through nearby line faults.

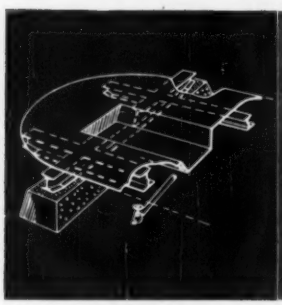
Capacitor Facts Fast! Call, wire or write...

ALLIS-CHALMERS A-C

A-1188-E

NEW Allis-Chalmers small power transformers install for less . . .

LIGHTER! LOWER!

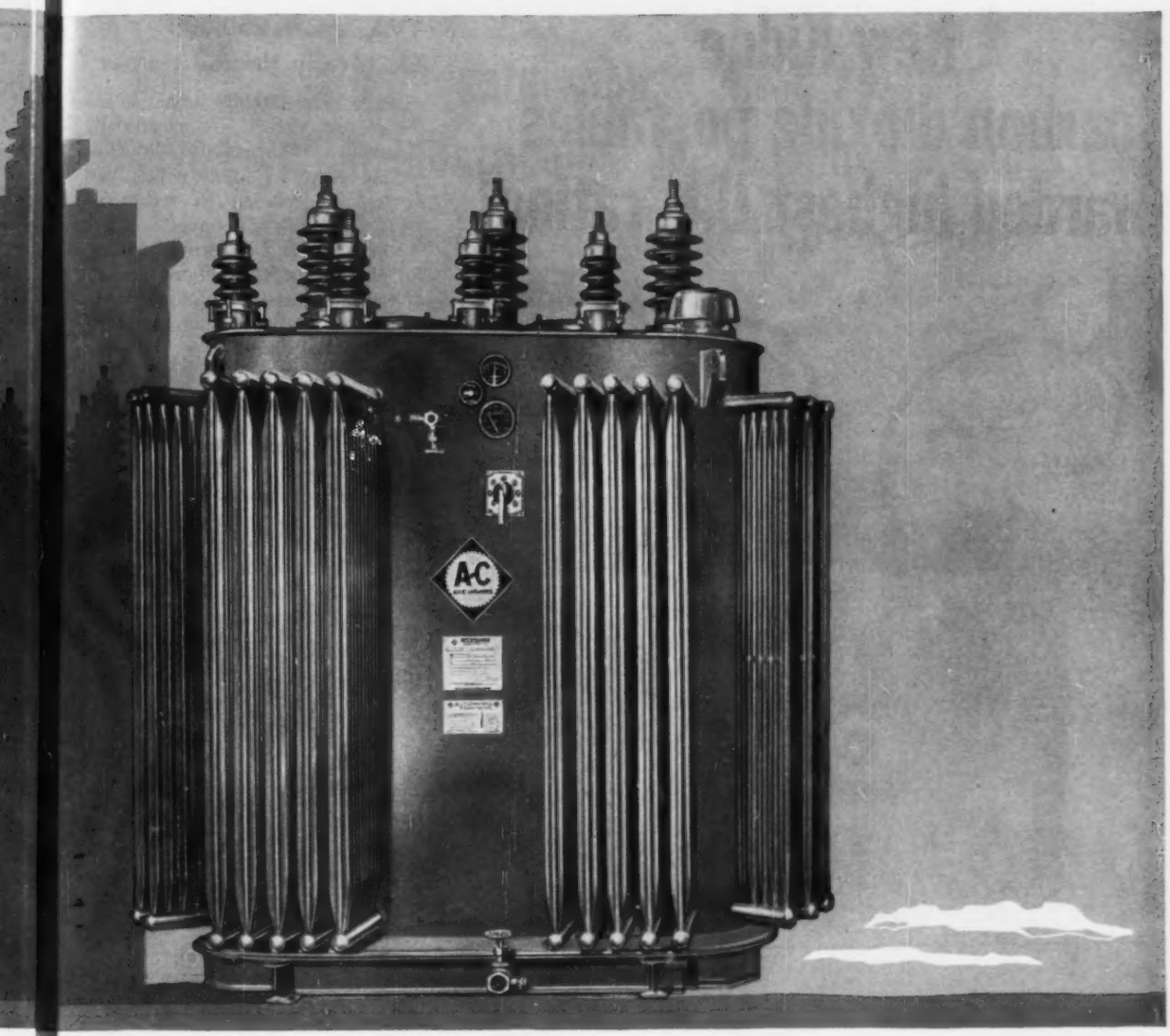


New base design permits mounting on smaller pads, low-cost piers or concrete planks.

Grouped instrument arrangement at convenient height for easier reading.

Self-resetting mechanical relief device automatically resets and reseals after operation.

Simplified hand-hole covers use only 5 captive "J" bolts instead of 14 loose nuts.



BY 30%!

- **Slashes installation costs**
- **"Hide-away" design** with lower profile
- **Instruments grouped** for operator convenience
- **Base designed** for pier or pad mounting
- **Cleaner appearance,** easier to maintain — no external bracing

ALL new—lower, lighter too!

How's this for weight savings? The 34.5-kv, 3750-kva transformer, for example, is now 8000 lbs. *lighter* than its predecessor . . . brings big savings in handling and pad costs. Losses, exciting current and noise level are also reduced.

Easier servicing! Base sump collects any contaminant, removing it from active oil, permits sampling and draining at very bottom. Tap changer easily operated from ground level. Unit is reinforced from *inside* — smooth, clean appearance — no external bracing.

There's more savings to this A-C story. Get the details at your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-1178-E

New Kidde carbon dioxide portables awarded highest U.L. rating!

Belleville, N. J. — A spokesman for Walter Kidde & Company announced here today that four of the company's new portable fire extinguishers have been awarded the Underwriters' Laboratories highest ratings for their respective capacities. To those interested in fire safety, this means that, pound for pound, these new Kidde units have more fire-killing power than any other carbon dioxide extinguishers on the market today.

Available in 15 and 20 pound capacities, in either squeeze valve or trigger models, these power-packed Kidde units feature new hose and discharge horn assemblies, which are responsible for their extra fire fighting ability. The new assembly is supplied also with Kidde's 10 pound carbon dioxide portable which has a U. L. rating not exceeded by any other extinguisher of its capacity. This hose-horn combination is also being offered as a replacement unit for existing 10, 15 and 20 pound carbon dioxide units, and when attached will upgrade their effectiveness equal to the new ratings.

For more information on these top-rated Kidde carbon dioxide portables write Kidde today.

Kidde

Industrial and Marine Division
Walter Kidde & Company, Inc.
1030 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd.
Montreal — Toronto — Vancouver

TVA Reports 250,000 Electrically Heated Homes

More than 250,000 homes in the Tennessee Valley are electrically heated, the Tennessee Valley Authority reports. Areas which had no electric heating as recent as three years ago now have it.

One of the factors responsible for this is the tremendous growth of summer air conditioning loads on electric distribution systems. Many electric utilities are now actively promoting heating to offset the summer peaks created by air conditioning, the report said.

The report also noted that there is a rapidly spreading interest in the use of electricity for school heating, adding that in the TVA area there are 18 all-electric schools, with 12 more to be built.

Electric Furnaces Sell Well in Northwest

Electric furnaces, the latest type of electric heat appliance, are selling well according to Wm. Nordeen, manager, Douglas County (Wash.) Public Utility District. Manufacturers have found that customer especially like the new electric furnaces because they have, in one package, year around comfort with heating, cooling, humidity control and air cleaning with electrostatic filtering, he reports.

Nordeen also predicted a large market for electric furnaces. "Interest is high in our area," he said, "and in many cases our customers can use their existing duct work and install an electric furnace for a modest cost."

Air Conditioning Found Beneficial for Babies

Central air conditioning is as important as heat where children are concerned. So states a New Jersey housewife. Noticing air conditioning in a hospital delivery room and a nursery she was concerned about the health of new infants. A doctor said babies sleep more comfortably,

(*Continued on page* 122)

the Westinghouse MG-6 relay gives you 6 electrically independent contacts for protective relaying or industrial control

The MG-6 relay was designed specifically for those applications where electrically independent multiple contacts are desired. The 6 contacts of the relay are readily reversible to provide make or break circuits as required. Each contact circuit is capable of carrying 12 amps continuously or 30 amps for one minute. If desired, the MG-6 can be supplied with an additional snap-action contact which de-energizes the relay's operating coil when the armature closes.

The MG-6 has an operating time of approximately 2 cycles on a-c and 5 cycles on d-c (on 60-cycle base) when operated at rated voltage. Self-reset or latch-in types with manual and electrical reset features are available for projection or semi-flush mounting in the molded case, or in the Westinghouse Flexitest* case with built-in test facilities.

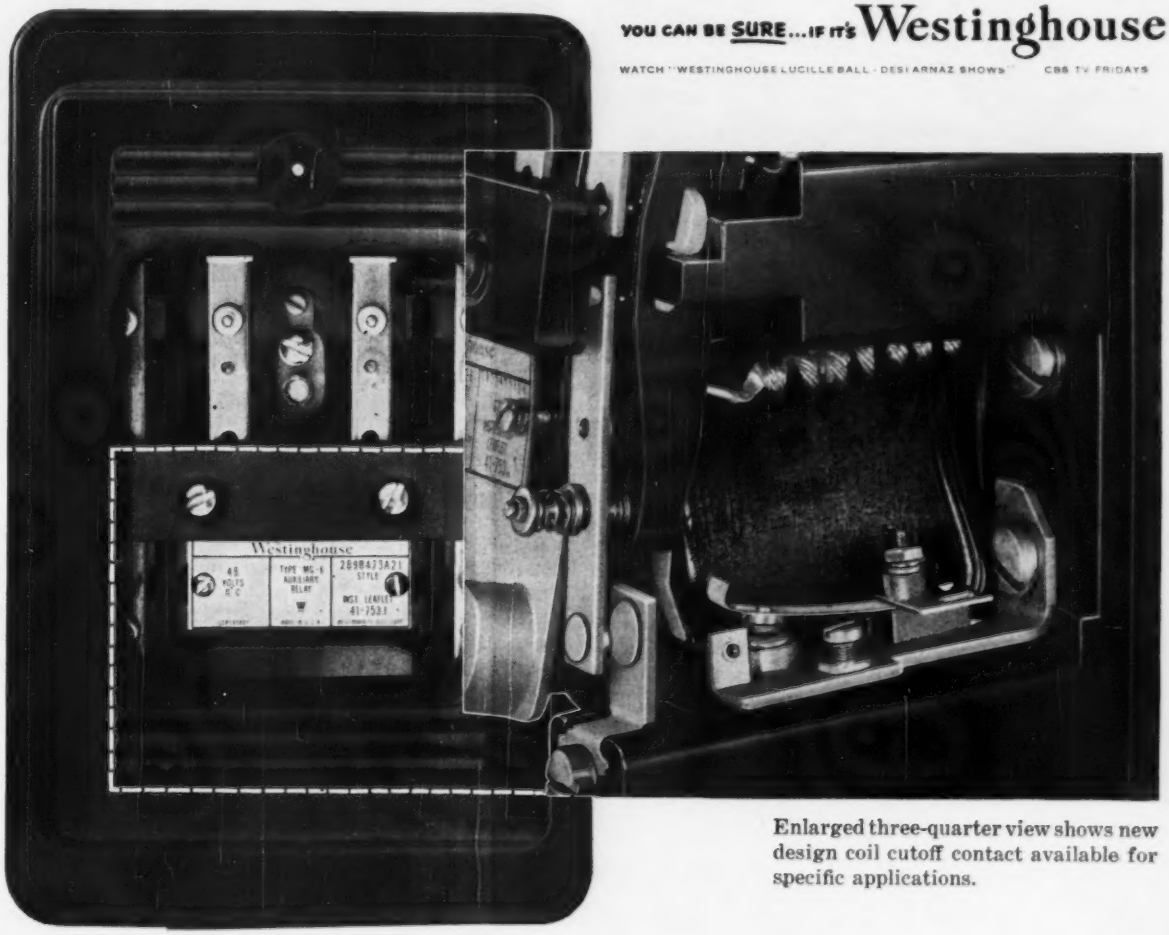
MG-6 contacts will interrupt 30 amps at 115 volts, 60 cycles, or 3 amps at 125 volts d-c, in a non-inductive circuit. Relay operating coil ratings available are 1 to 5 amps d-c, 6 to 250 volts d-c, or 115 to 575 volts, 50/60 cycles.

For complete information and assistance on how the MG-6 can solve problems in your own system, call your Westinghouse sales engineer, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-40522

*Trade-Mark

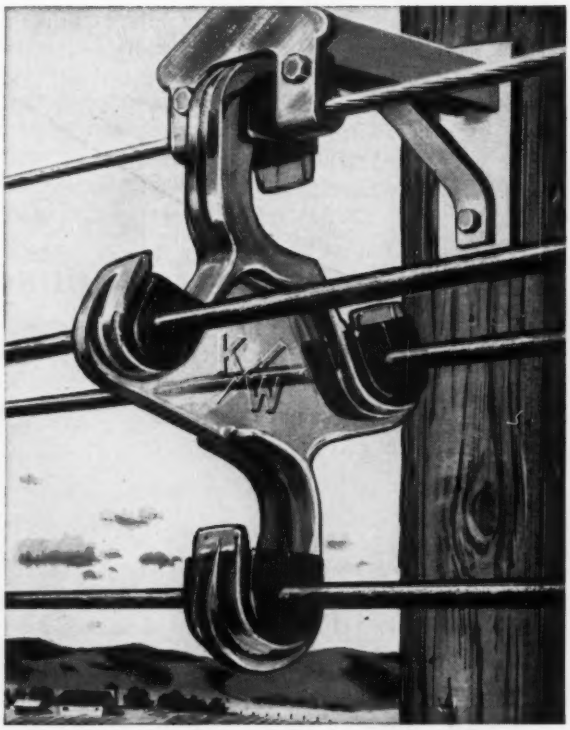
YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL - DESI ARNAZ SHOWS" CBS TV FRIDAYS



Enlarged three-quarter view shows new design coil cutoff contact available for specific applications.

NEW K/W SPACER TYPE AERIAL ADDS STRENGTH, CUTS COSTS,



One-Piece Design—Supports 1200 Pounds

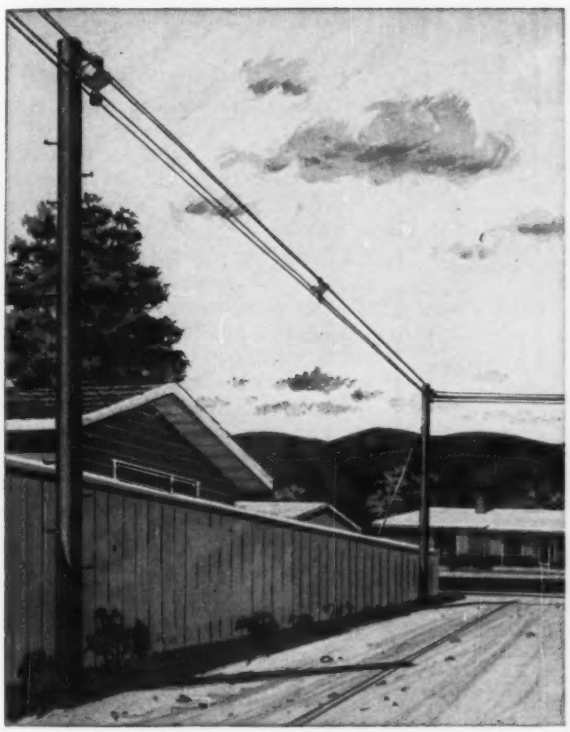
New solid spacer design has no loose parts nor movable pieces . . . it's simple, reliable and strong. Can support a minimum distributed load of 1200 pounds. Easy to install, since only one conductor is handled at a time. Snap-in grommets shaped to ease installation. Can be used with or without crossarms; standard hardware available from many suppliers.

Cuts Material Costs and Tree Trimming

A KW Spacer Cable system can be installed for as little as one half the cost of standard pre-assembled aerial cable!

Compared to open-wire weatherproof, the reduced tree trimming and improved system dependability resulting from messenger supported cables can justify the spacer system's slight additional cost.

CABLE SYSTEM IMPROVES APPEARANCE



Reduced Spacing Improves Appearance

Compared to open wire, closely spaced conductors present a neat, compact arrangement that improves appearance wherever it is installed. Close 6-inch spacing also improves system electrical characteristics . . . permits easy phase identification and proper load balancing. Usual installation practice is approximately 35 spacers per 1000 feet.

WITH its unique new spacer design, KW now offers you unsurpassed dependability and handling ease for cable systems operating at 5 to 15 kv, by using only one spacer for the whole range of voltages.

No tools or tightening necessary: entire spacer system snaps in and locks.

The system consists of four parts: (1) Phase conductors (EC grade aluminum, minimum conductivity 62 per cent, insulated with Polyethylene or Butyl rubber with Neoprene jacket); (2) Special high-strength messenger; (3) Molded one-piece spacers; (4) Molded Neoprene cable-retaining grommets.

Standard hardware is available from leading suppliers. Call your Kaiser Aluminum sales office or KW distributor for immediate service and full information.

Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

KAISER ALUMINUM

"IF IT CARRIES CURRENT, KW CARRIES IT!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

From regulator to lamp

. . . use cost-saving

SUPERIOR CABLES

Thermoplastic Series Lighting Cables

- High resistance to earth acids and alkalis
- High resistance to sunlight, moisture, weather
- Small diameter, lightweight
- Easy to splice

Figure 8 Pole & Bracket Cable

- High resistance to abrasion, mechanical damage
- Does not deteriorate with age or weather
- Will not support combustion
- Flexible, strips clean, speeds installation

Performance and economy go hand in hand with SUPERIOR plastic insulated and jacketed cables.

All SUPERIOR CABLES are quality-engineered, precision manufactured and thoroughly tested.

From regulator to lamp . . . for low initial cost . . . for less maintenance cost . . . order SUPERIOR CABLES!

For complete information and prices, write

SUPERIOR CABLES

SUPERIOR CABLE CORPORATION

Hickory, North Carolina

3869

Air Conditioning

(*Continued from page* 118)

don't perspire and thus don't lose weight, feeding problems are easier, and babies don't come down with prickly heat.

Other findings at a conference held by Lennox Industries Inc to survey 17 women who had been living in air conditioned houses for a year or more: Air conditioning gives more "pep;" it's beneficial for asthma sufferers; less dirt in the home; people stay at home more, and entertain more frequently.

Air Conditioning Effective In North Year Round

Year around air conditioning is effective north as well as south of the Mason-Dixon line according to Elmer Dittrich, Amana Refrigeration, Inc. While electric power companies have played a major role in popularizing electric resistance heating in northern climates, much public education remains to be done on heat pumps, he noted. He cited two major selling points: A cleaner home and less housework because of the lack of combustion; and an automatically maintained comfortable humidity ratio. He also cited a study of 13 Iowa homes heated by electric resistance elements for which the heating cost per home averaged $230.81, thus demonstrating the economy of year-round air conditioning.

Toledo Business Section To Have Better Lighting

Toledo, Ohio will increase the foot-candle density of its downtown business area street lighting from the present 0.8-1.2 to 3.0-6.0 ft.c. The project calls for the installation of 280 fluorescent lamps that will provide illumination of six ft-c at intersections and three ft-c between blocks.

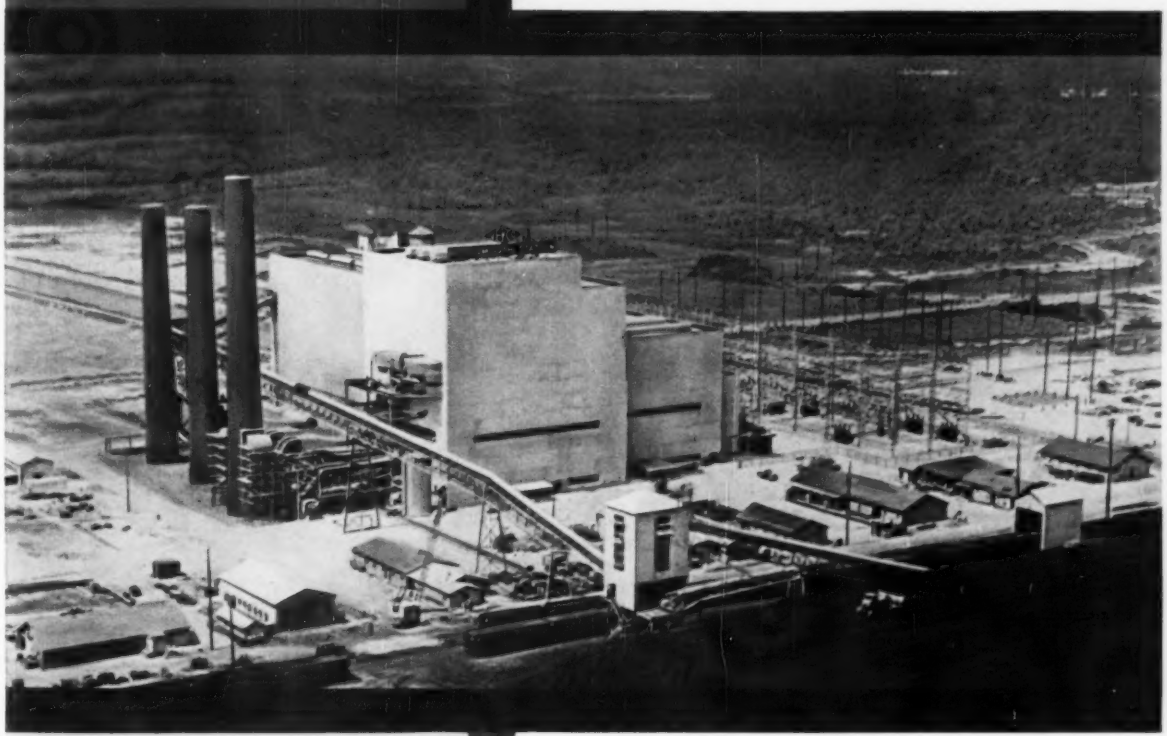
The annual total cost under a contract with Toledo Edison will be $86,000. Of this the city will pay $11,000.

One aim of the new lighting is to make the property more attractive to potential renters.

In Virginia, Stone & Webster Builds A Big One To Grow On

To meet mounting power demands in the Norfolk-Portsmouth area, a third unit at Portsmouth Power Station went on the line for Virginia Electric and Power Company in June, 1959. Designed and constructed by Stone & Webster Engineering Corporation, in close cooperation with the utility's own engineers, this new 150,000 kw Unit exceeds Units 1 and 2 by some 50,000 kw capacity and increases steam conditions from 1,450 to 2,200 psi.

Stone & Webster engineers constantly seek to incorporate new operating and construction economies into every project they undertake. To find how we could serve you profitably on your next engineering job, please call or write our nearest office.



Stone & Webster adds profits to your project through engineering economies and plant efficiency.

STONE & WEBSTER
ENGINEERING CORPORATION

A SUBSIDIARY OF
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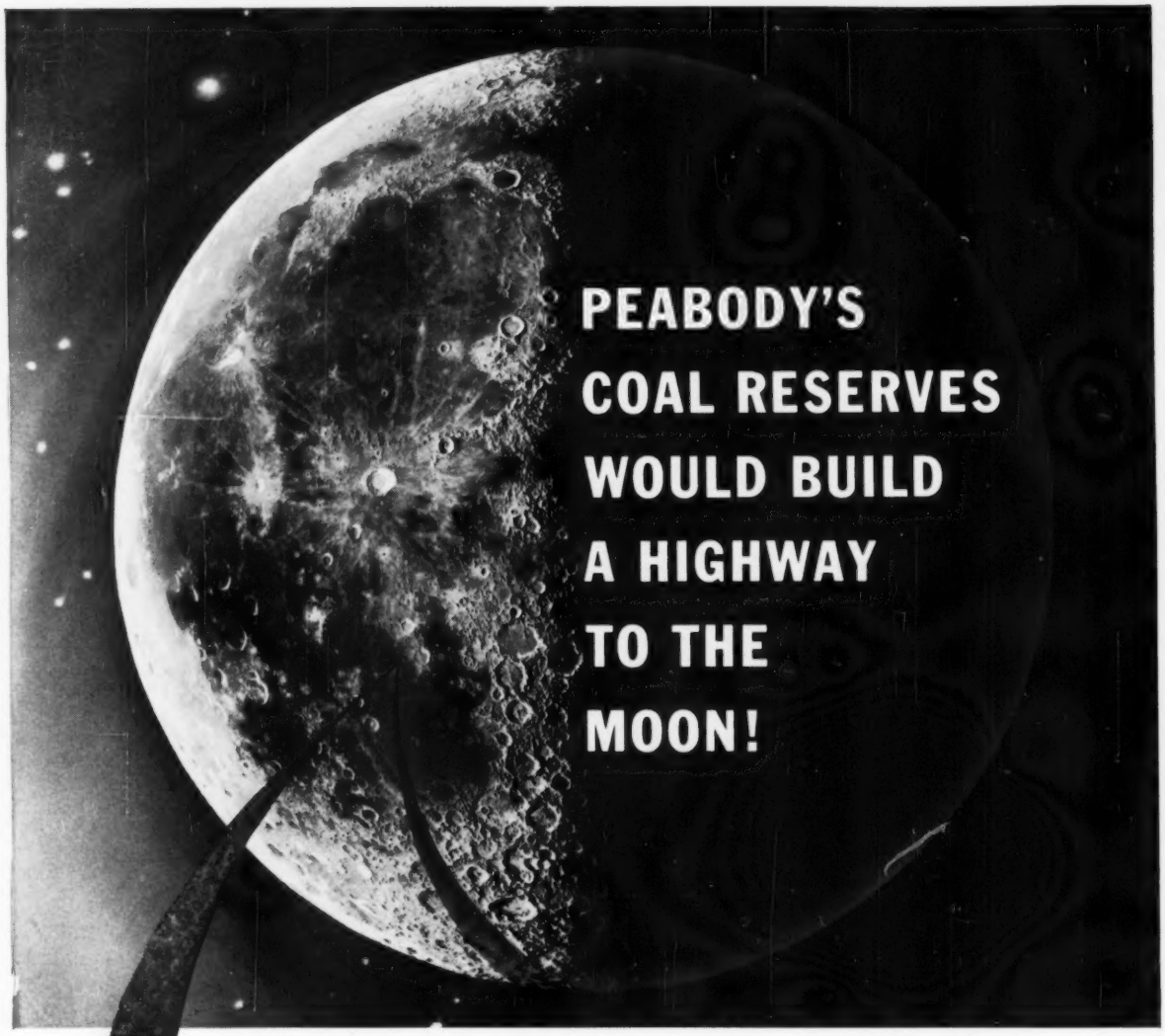
San Francisco Los Angeles Seattle Toronto



This Tremendous Coal Reserve . . . Over Two Billion Tons . . . Is Your Assurance of a Dependable Source of Fuel

Peabody's Coal Reserves are large enough to build a highway to the moon . . . 40 feet wide and 1 foot thick. They could light and power Chicago for 200 years or power all of New York City's television sets for 1,644 years. That is a *lot* of coal . . . it is a dependable source for you. These vast reserves . . . strategically located near the nation's inland waterways . . . plus Peabody's knowledge of low-cost production . . . are your assurance of an economical supply of coal for years to come. And at Peabody mines, coal is tailor-made to get maximum efficiency from your burning equipment. Your nearest Peabody representative can give you complete details.

Get your free booklet, "This Is Peabody Coal Company," and learn more facts about PEABODY and its complete coal service. Write Department EW.

power for progress

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Economic Depreciation

Bar Association Weighs ED Plan

An event that took place recently at the American Bar Association meeting in Miami, Fla., inspired mixed feelings among utility advocates of economic depreciation. The event was passage of a resolution to draft legislative proposals which would, if passed by Congress, permit taxpayers to compute their depreciation deductions based on the present value of their property rather than on its original cost.

The resolution originated in the Association's Depreciation and Amortization Committee, a part of the Section of Taxation. Reported out of the committee by a 47-0 vote, it was passed by the Section of Taxation after some debate. Stressing the need for action on economic depreciation, the committee's report said: "The inflation from World War II to date has accounted for a decline in the purchasing power of the dollar in excess of 50%. A business enterprise must spend more than two dollars to replace each one dollar of original cost of pre-1940 assets retired. The inflationary fact is ignored in the computation of taxable income, for the federal government takes 52% of a theoretical income out of funds which should be retained to maintain the enterprise intact—before there is any actual income." The section instructed the committee to prepare appropriate legislation which will eventually be considered for endorsement by the American Bar Association.

This does not mean that economic depreciation will be before Congress soon. Before any action is taken on this proposal, it will have to be approved by the House of Delegates or the Board of Governors of the Association, and this cannot take place before next year's meeting. The Bar Association may then turn down the proposal, of course, or alter its provisions substantially before it ever reaches a Congressional hopper. But in spite of these obstacles, some champions of economic depreciation have hailed the action at Miami as "a significant step forward." Endorsement by such a group as the American Bar

Association, if it should be forthcoming, would increase the chances of economic depreciation for tax purposes ever becoming a reality, and would at the very least provide a public forum for debating its merits.

Some utility men have serious misgivings about the resolution, however. While the committee's recommendations appear to wrap up the economic depreciation problem in non-regulated industry, they unquestionably leave gaping holes from the utility standpoint. Here is the actual text of the committee's proposal:

"Resolved, that the Section of Taxation directs the Committee on Depreciation and Amortization to prepare for submission for Section action appropriate legislative proposals which adopt in principle the allowance of an annual deduction for depreciation determined by (1) revaluing the investment in depreciable property by applying to each year's costs an index factor to convert such costs to the dollar equivalent as of December 31 of the preceding year, (2) subtract the accumulated reserve for depreciation at December 31 of the preceding year comprised of the sum of the prior years annual allowances so computed less the retirements priced at the dollar costs factored to the years of retirement, and (3) amortize the balance over the expected remaining lives of the surviving property. At the election of the taxpayer the amount allocable to the current year may be computed as the basis of the sum of the years digits."

How 'Dollar Value' Depreciation Works

The table at the top of the opposite page shows how this revaluation works on a straight-line basis. In the illustration, depreciation was accrued on original cost from 1954 through 1958, although inflation proceeded at a 3% annual rate during the period. By the end of 1958, the gross plant balance amounted to $5,310 and the depreciation reserve amounted to $2,592. This left an unrecouped portion of $2,718 with an average remaining life of 2.56 years. Computed on an original cost basis, the depreciation charge for 1959 would be $2,718÷2.56=$1,078.

Under the dollar valuation method, however, each year's additions are revalued using a price index. The indexed balance at the end of 1958 thus works out to $5,628. The $2,592 depreciation reserve is not revalued. Subtracting it from the indexed balance leaves an unrecouped portion equal to $3,036, which is divided by the remaining life (2.56 years) to come up with the 1959 depreciation charge of $1,186. This method compensates for the deficiencies arising from past depreciation allowances based on original cost only.

In subsequent years, the same procedure is followed. When retirements take place, they are revalued. Each year's depreciation deduction is equal to the unrecouped balance at the end of the preceding year divided by its remaining life, which holds steady at 2.56 years for property of five-year average life. Thus the 1960 depreciation deduction would work out to $1,241, as against $1,110 using original-cost depreciation. "Under this method," the committee points out, "the accumulated underages of past years will be recouped over the remaining life of the surviving property."

Although it is not shown in the illustration, the committee's proposal also provides for the use of the sum-of-the-years-digits method for computing the amount of depreciation allocable to the current year. According to the committee, this device was introduced in order to correct "the ascending pattern of the annual deductions." It should be mentioned that the SYD method will not only cure the ascending pattern of depreciation deductions, but also will increase them materially. Use of straight-line and dollar-valuation depreciation

Illustration of 'Dollar Valuation Depreciation'

Assume 3% Annual Inflation—5 Year Average Life
Retirements on First-In First-Out Basis

Assumed Basic Data—Original Cost Basis	1954	1955	1956	1957	1958	1959
Additions	1,000	1,030	1,061	1,093	1,126	1,159
Retirements	–0–	–0–	–0–	–0–	–0–	1,000
Balance End of Year	1,000	2,030	3,091	4,184	5,310	5,469
I Straight Line and Original Cost Basis						
Average Balance	500	1,515	2,560	3,638	4,747	5,390
Annual Depreciation	100	303	512	728	949	1,078
Reserve End of Year	100	403	915	1,643	2,592	2,670
Unrecouped End of Year	900	1,627	2,176	2,541	2,718	2,799
Remaining Life—Years	4.50	4.01	3.52	3.04	2.56	2.56
II Straight Line and Dollar Valuation after 1958						
Price Index	100.0	103.0	106.1	109.3	112.6	115.9
Indexed Balance End of Year	1,000	2,060	3,183	4,371	5,628	5,797
Indexed Retirements	–0–	–0–	–0–	–0–	–0–	1,159
Annual Depreciation						1,186
Reserve End of Year					2,592	2,619
Unrecouped End of Year					3,036	3,178

in the example would result in annual depreciation deductions climbing gradually from $1,186 in 1959 to $1,426 in 1964. With SYD and dollar valuation, the annual deductions would start off at $1,854 in 1959 and drop to $1,483 in 1964.

What About Rates and Accounting?

The utilities' chief objection to the committee's proposal is that no mention is made of rate-making or accounting. Unless any economic depreciation law touches on these aspects of the problem, the objectors claim, it could quite possibly do the utility industry more harm than good. Experience with the much smaller tax benefits of Section 167 indicates that many utilities which chose to adopt economic tax depreciation would find their regulatory commissions disposed to "flow through" all tax savings to the rate payers. This would leave the utility's property in the same state as before.

Making economic tax depreciation permissive, as the committee proposes, will not stop a commission from imputing it to a utility in a rate case, whether the utility has chosen to "take" economic depreciation or not. Objectors point to the Maine PUC's recent action in the Bangor Hydro-Electric Co case, where the company did not use Section 167, but the commission set its rates as if it had done so.

The sums involved in economic depreciation would be so much greater that other states such as New York and California, which now are prescribing flow-through only when a utility takes liberalized depreciation, might well change

their minds and adopt the rate treatment prescribed in Maine. In other words, many commissions might argue that it is the duty of utility management to minimize expenses, and that the permissive character of the economic depreciation law is not a valid reason for a utility to pass up its benefits.

A utility could find its effective return jacked up by as much as 50% if it used economic depreciation for tax purposes but allowed the benefits to flow through into earnings instead of into a reserve. The utility would then probably have to cut its rates, while inflation continued to chew up its capital as before. For utilities whose return is insufficient under the present original-cost method of tax depreciation, there might be no rate cut, and in effect economic depreciation would put them in the position of not having to go to the commission for a rate increase for many years to come. Far from accomplishing its purpose of preserving capital intact, economic depreciation for tax purposes only would become another tax "gimmick" for promoting a painless increase in earnings.

The objectors want to head off this situation before it happens. They feel that economic depreciation is desirable—more so in the utility industry than in most others, since the utilities' investment in plant is so large and their plant is considerably older than that of most industries. However, they say, it can only be economically sound if it is used for rate-making and accounting purposes as well as for tax purposes.

One spokesman for the objectors told how this could be done. His plan: "Instead of the proposal made by the Committee on Depreciation and Amortization, the electric utility industry should petition Congress to pass an act prescribing special treatment for public utilities in view of the regulated character of their business—just as the Excess Profits Tax Act of 1950 included the 'Regulated Public Utility Credit.' A similar enactment dealing with economic depreciation would state that only those utilities whose commissions have allowed them to take economic depreciation for both rate-making and accounting purposes would be permitted to avail themselves of economic depreciation for income tax purposes."

A Couple of Complications

Another objection to the committee's proposal concerns the attempt to recoup past arrearages. However desirable this might be, the objectors point out, it is impossible for a regulated utility to do it. The courts—including the U. S. Supreme Court—have ruled that present customers cannot be forced to make good the losses of the past, and regulatory commissions might well take the position that past losses should be recouped by charges against surplus rather than by burdening today's customers with them.

Still another objection is to the use of SYD in connection with economic depreciation. One advocate of the principle of economic depreciation describes this as a case of "eating your cake, then selling it, and still claiming title to it." "Why drag that in?" groans another. "It complicates the issue unnecessarily, and, so far as I can see, will aggravate rather than cure the 'ascending pattern of annual deductions.'"

"So far as the utility industry is concerned," he continued, "the proposal has little to recommend it in its present form. On the other hand, the basic principle of economic depreciation is sound, and I can see no reason why it can't be stripped of its irrelevant and impractical details, strengthened to ensure that the tax savings would actually serve the purpose for which they are intended, and emerge as a sensible piece of legislation."

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of all electric baseboard heat!

Arvin

Invisa-Line

with exclusive safety limit thermostats

Here is the most advanced, most thoughtfully engineered and the most wanted of all electric baseboard heat. Thinner, lower, trimmer styling . . . lower, completely safe surface temperature . . . heavy, rod type heating elements for maximum efficiency and long life . . . new, easier methods of installation are all powerful selling features of Arvin Invisa-Line.

Arvin Lo Wattage units are a scant four-and-one-half inches high—a sleek one-and-three-quarters inches thin. Hi Wattage units are scarcely six inches high and two inches thin. Both hug the wall and disappear from conscious view once installed!

Arvin Invisa-Line comes in convenient-to-install pre-wired sections that are easily joined at either end to provide the exact amount of heat needed. Each section, depending on length, contains one or more safety limit thermostats—another Arvin *exclusive* that makes the safest heat even safer.

Take full advantage of the profit potential presented by the strong trend toward electric heat. Offer your customers wonderful new Arvin Invisa-Line Baseboard Heat. It is destined to dominate the field!

Arvin Lo Wattage Section

Arvin Hi Wattage Section

All Arvin Invisa-Line sections are attractively finished in the finest beige enamel, backed on for lasting beauty.

Sections can be painted to match walls or baseboards. Note handsome chrome plated top grille that prevents objects from falling into units and aids in directing warm air flow into room.

In Arvin Invisa-Line, the rod type heating unit is welded to continuous radiating fins and units are mounted on full-floating holders to allow expansion and contraction without popping or cracking. Units are fully guaranteed for five years.

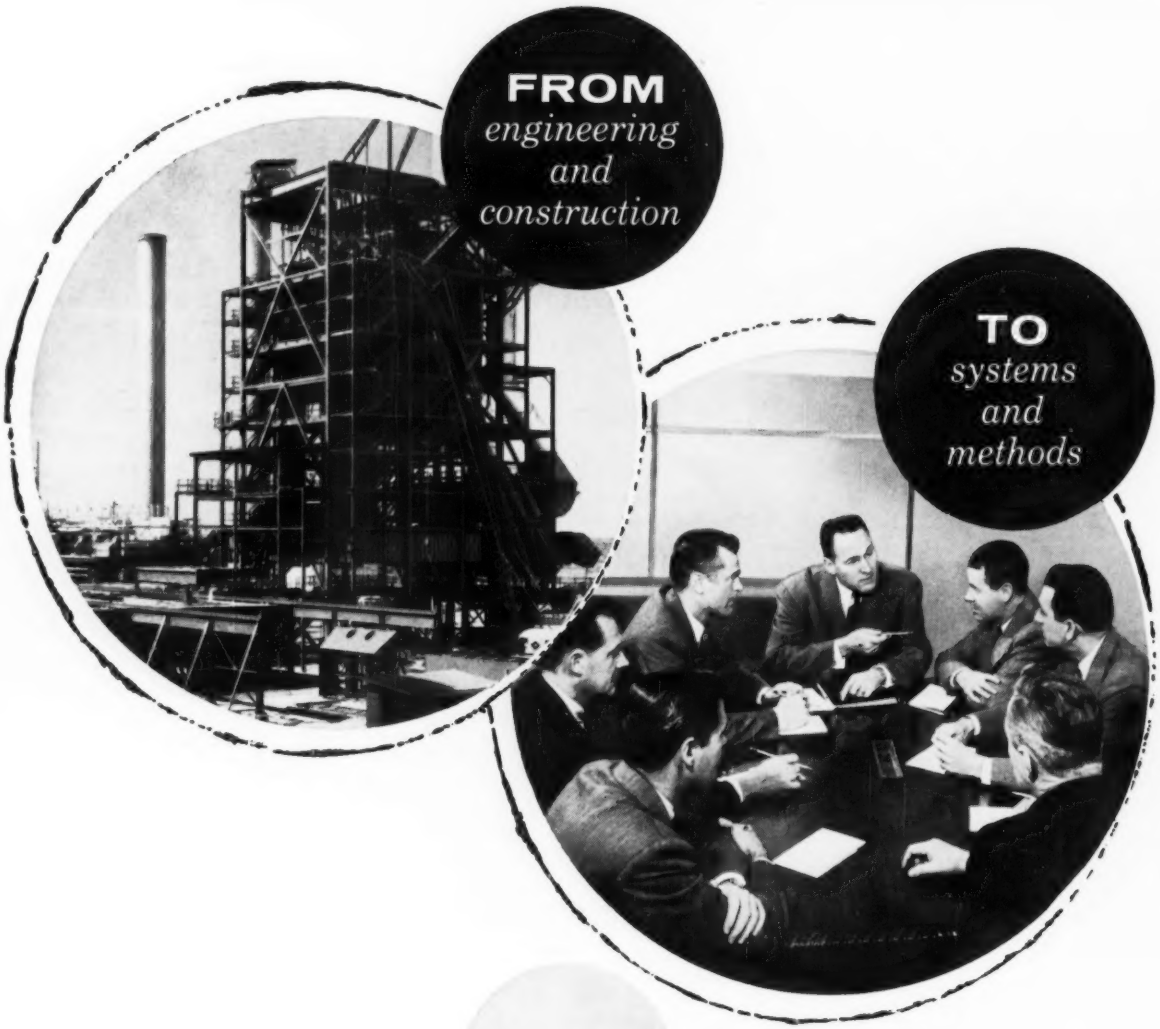
Small, compact, convenient thermostat baseboard sections are available for more economical installations of heat control. These save "wiring in" wall thermostats, a feature your customers will appreciate. Wall thermostats can be used if desired, however.

Arvin

Consumer Products Division

ARVIN INDUSTRIES, INC.

COLUMBUS, INDIANA



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One of these services—*accounting and office systems and methods*—helps companies meet the challenge of ever-increasing complications and costs in this important area of operations. An Ebasco methods improvement program can help point the way to better service and lower costs for your company. These programs are based on years of concentrated experience with companies large and small—and backed by continual research in new methods and up-to-date machine equipment.

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VALUATION AND APPRAISAL • WASHINGTON OFFICE

Clawson Elected President of Puget Sound

J. H. Clawson, the former executive vice president of Puget Sound Power & Light Co, has been elected president. Frank McLaughlin who had been president and chief executive officer has been elevated to the post of chairman and top managing officer in charge of policies, business and affairs.

Clawson joined the utility in 1933 as an auditor, after 11 years in that capacity with Stone & Webster. In 1936 he became assistant treasurer and, in 1946, controller. The following year he was named treasurer and then a vice president in 1958. In May of this year Clawson was made senior vice president.

McLaughlin has served as president and director of Puget Sound Power & Light since 1931.

Knittel Named Co Purchasing Agent

Henry C. Knittel has been named general purchasing agent for Pennsylvania Power Co.

Joining the Penn Power system in 1927, he began working as a storeroom clerk in Youngstown, Ohio, for the Pennsylvania-Ohio Power & Light Co. In 1928 he was promoted to purchasing department duties and he has been in the purchasing field ever since.

In 1931 he was promoted to assistant purchasing agent for Pennsylvania Power Co in New Castle, Pa.

Knittel is an active member in the Pennsylvania Electric Assn, serving as a member of the Stores Committee for the past seven years. He is now a member of the Purchasing Committee of the PEA.

Allis-Chalmers Makes New Vice Presidential Appointments

Allis-Chalmers Mfg Co has elected two new senior vice presidents and two vice presidents. J. L. Singleton and Boyd S. Oberlink were named senior vice presidents; Roy M. Caspar, general manager of the firm's Atomic Energy Division, and L. W. Davis, general manager of the Farm Equipment Division, were both elected vice presidents.

SINGLETON

OBERLINK

CASPAR

Singleton began his career at Allis-Chalmers in 1926. He worked in various departments including processing machinery and power generation before going to the Denver, Colo, district sales office in 1930. He was named director of sales for the Industries Group and a vice president of A-C in 1947. In 1951, he was named group vice president and elected to the board of directors the same year.

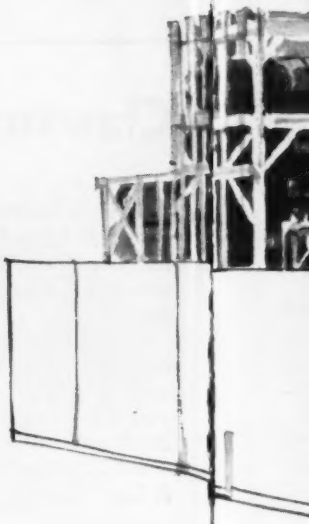
Oberlink joined Allis-Chalmers in 1934. He was named a vice president in 1951, vice president, Construction Machinery Division in 1955, and group vice president in 1956. He was elected to the board of directors in 1957.

Caspar joined the company in 1936 as a sales representative. He was named general manager of the Nuclear Power Division in 1957.

Davis assumed his position as general manager of the Farm Equipment Division in 1955.

(*More News About People, p* 134)

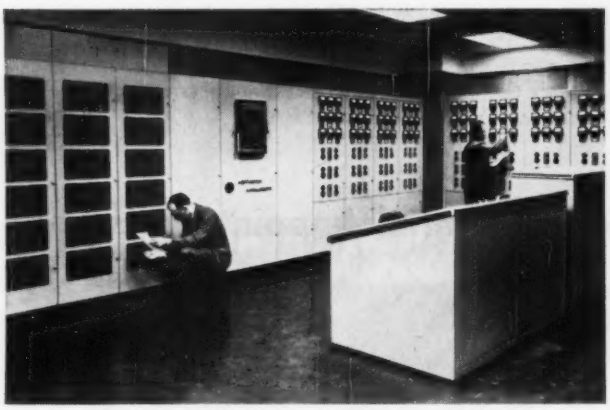
COMPACT



What! Call this giant 138 kv switching station compact? Yes indeed. In fact, it takes up an area roughly 30% smaller than would be required by conventional open construction. That's because it uses I-T-E isolated phase construction.

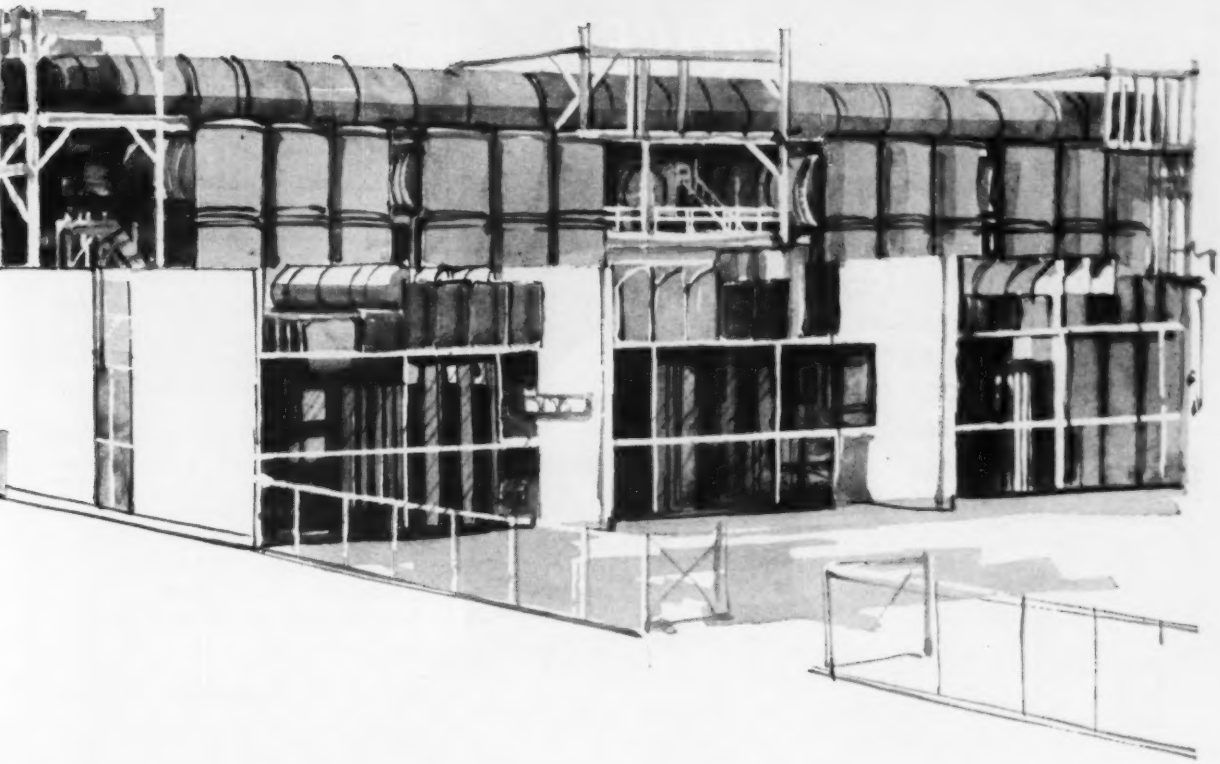
I-T-E high-voltage metal-enclosed switching stations can be installed in relatively small spaces with complete safety to personnel and nearby equipment. Maintenance is considerably easier. And in addition you are assured of better service continuity through virtual elimination of phase-to-phase fault risk. All conductors are completely enclosed.

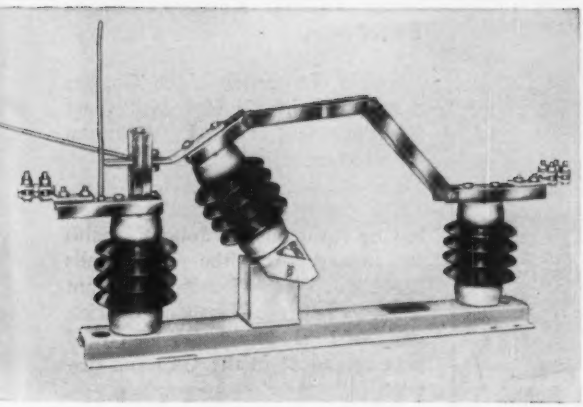
The 138 kv installation illustrated was made at Consolidated Edison, New York. It was the first at this high voltage. It was logical that I-T-E should supply it. I-T-E introduced isolated phase bus . . . in 1937. Today some 25% of the nation's electric power flows through I-T-E bus. And other big advances in electrical equipment keep coming your way from I-T-E.



Duplicates an entire distribution network. Here at I-T-E headquarters, the I-T-E Network Analyzer gives fast, accurate answers to complex distribution problems. You can rent its services for problems of any complexity. Removable patchboard saves time. While one problem is being solved, the next problem can be set up. Five-degree phase shift design permits direct load setting on panel face. Automatic regulation maintains loads even though voltage changes. High impedance, 4000-ohm, 25-milliamp base prevents component damage from high currents. Resistors and reactors are separate, can be set independently.

New, more compact secondary unit substations. Save space at your generating station. Now I-T-E secondary unit substations need less space than ever. K-LINE circuit breakers stack four high in ratings up to 600 amp. They save roughly one-third in space. In addition, you get these other K-LINE advantages: quick manual make, closed door drawout even to disconnect position, expanded range trip unit that multiplies the application range. Only I-T-E builds these substations in a single plant . . . coordinating engineering and manufacture of interrupting switch, transformer and switchgear, and giving you better assurance of on-time delivery.





Shuntless tilting insulator switches. Note the absence of corrosion-prone flexible braid on I-T-E Tilting Insulator Switches. Instead they use a durable current-carrying linkage with silver-to-copper contacts at each hinge point. Silver to copper is also employed between the blade and jaw contacts. New crossarm adjustment permits compensation for warpage without demounting switch. Current rating can be increased with parts supplied in an easy-to-use conversion kit. Available with I-T-E LODRUPTER attachments for switching currents up to 600 amp. Switch voltage ratings from 7.5 through 34.5 kv.

I-T-E Circuit Breaker Company U-5
1900 Hamilton St., Philadelphia 30, Pa.

- ☐ Metal-enclosed high-voltage switching stations
- ☐ Network analyzer
- ☐ Secondary unit substations
- ☐ Tilting insulator switches
- ☐ Outdoor air switches
- ☐ Load interrupter switches
- ☐ Reclosers
- ☐ Distribution cutouts
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Get complete, up-to-date information on I-T-E equipment.

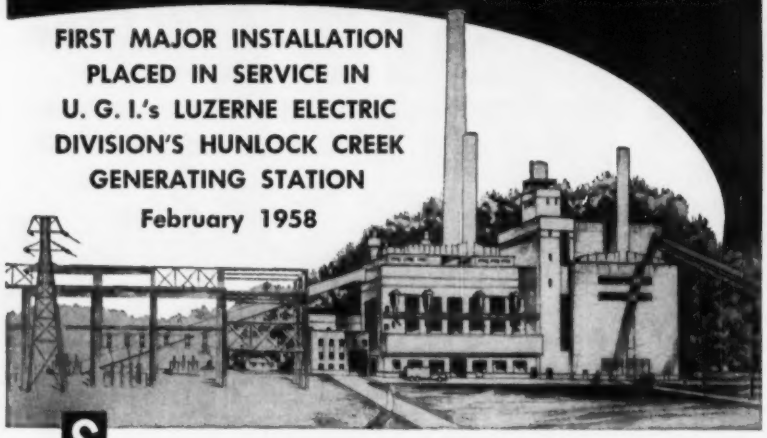
I-T-E CIRCUIT BREAKER COMPANY

GTC PROVED RELIABILITY

IN-PLANT COMMUNICATION SYSTEM

FIRST MAJOR INSTALLATION PLACED IN SERVICE IN U. G. I.'s LUZERNE ELECTRIC DIVISION'S HUNLOCK CREEK GENERATING STATION

February 1958



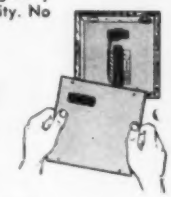
Since that time, the GTC system delivered constant, uninterrupted service. New plant unit will include extension.

This installation, as well as thousands of GTC units that have been installed in power stations and industrial plants throughout the United States since, have definitely established the superiority and reliability of GTC in industrial voice communications.

Features contributing to GTC's acceptance and reliability are:

1. Provides swift and sure voice communication even in adverse environmental conditions, such as extremes of temperature and noise.

2. All amplifiers are "plug-in" contributing greatly to ease of installation and maintainability. No central equipment is required.



3. Long-life transistors and rugged, industrial type components are used throughout. No vacuum tubes or "entertainment" type components are employed.

4. Inconvenience and expense of vacuum tube replacement is eliminated.

5. Design allows expansion of system from "very small" to "very large" by simple addition of units where required.

6. Ultra simple wiring plan (no shielded cables) and unitized equipment with integral terminal facilities make for easy low cost installation.

*Gai-Tronics Transistorized Communications is an effective, economical industrial communication system designed to provide swift and sure voice communications regardless of distance or surrounding noise conditions.

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GTC is extremely flexible in application. Write today for a copy of our completely illustrated, descriptive booklet and name of nearest representative.

PERSONAL BRIEFS

Thomas Hunter has been appointed superintendent of line engineering, transmission and distribution department, Duquesne Light Co.

A. L. Lamb has been named chief operator at the Southwestern Electric Co substation near Ashdown, Tex.

Carl T. Bremicker, vice president in charge of sales, Northern States Power Co, was elected chairman of the North Central Electrical League.

W. L. Westbrook has been promoted to manager of Georgia Power Co's Atlanta Division. He succeeded **H. G. Moore** who retired. Westbrook was succeeded by **S. F. Lambert** as Atlanta Division superintendent, and **C. C. White** assumed Lambert's post as assistant division superintendent.

Robert W. Retherford, electrical consulting engineer for rural electric cooperatives throughout Alaska, was named 1959 winner of the Milton Hunt McGuire engineering achievement award presented annually by the Northwest Public Power Assn.

Carolina Power & Light Co has named **Edwin G. Hollowell** plant superintendent at the L. V. Sutton steam electric generating plant.

Duke Power Co has made the following realignments: **John F. Smith** to manager of the Kannapolis branch; **J. Wesley Lewis** to assistant manager of the Durham district; and **Earl J. Norris** to electrical superintendent in the Gastonia district.

Columbus & Southern Ohio Electric Co has named **Jim Fenstermaker** assistant superintendent of generation; **Jack Nelson** superintendent of Pieway Generating Station; **Eugene Cavote** superintendent of Connesville Generating Station; **Kermit Nelson** superintendent of Poston Generating Station; **Harold Peck** superintendent of Walnut Generating Station; and **Kenneth Morris,** assistant superintendent of Pieway Generating Station.

(*More News About People*, p 136)

New ORANGEBURG® CA* CONDUIT *with Flush Coupling Attached!*

With no separate couplings to handle or attach on the job, Orangeburg CA lays faster, costs less to install. Each long, light length has a *flush* coupling attached at one end and a standard 2° male taper at the other end, making installation a simple, one-step operation. And, since the coupling *is* attached, there are no coupling cartons to warehouse or carry to the job.

What's more, with the coupling *flush* to the conduit's outside wall, new CA is easy to stack, store and handle. The flush coupling also eliminates "staggered" joints in the trench. And that means real savings in cutting and tooling time.

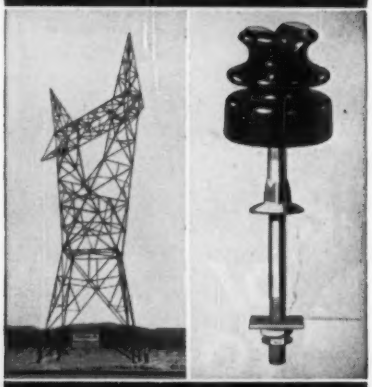
Like the hundreds of millions of feet of Orangeburg fibre conduit in use since 1893, new CA has self-sealing joints and impermeable walls. Its smooth, 100% fibre raceway adds years to cable life.

New Orangeburg CA is available in 2", 3", 4", 4½" and 5" sizes. Orangeburg Standard and Nocrete Conduit, with separate sleeve couplings, are available as always. Write Dept. EW-109, for Catalog 52.

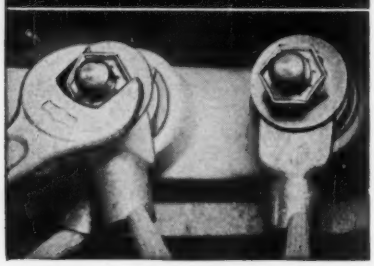
ORANGEBURG MANUFACTURING CO.
Orangeburg, New York • Newark, California
A Division of The Flintkote Company, Manufacturers of America's Broadest Line of Building Products

Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.

Assemblies stay tight!



Connections stay tight!



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PALNUT LOCK NUTS

FOR years, PALNUTS have been the standard lock nuts of the utility industry—on steel towers, wood pole hardware, connectors, disconnects, switches, fittings, transformers, etc. Here's why: PALNUT Lock Nuts stay tight under severest vibration, are very low in cost, apply fast and easily, require little space. Available in full range of sizes, in plain, Parkerized and Hot Dip Galvanized steel; also silicon bronze.

Samples and literature on request.

THE PALNUT COMPANY

51 Glen Road

Mountainside, N. J.

PALNUT

TRADE MARK

LOCK NUTS

for quick, secure fastening at low cost

Leonard F. Mettetal has become office manager of Keasbey & Mattison Co as a result of increased home office activities.

Brown Co has named **Theodore I. Montelin** to the position of steam engineer and **Edward L. Lynsky,** power engineer.

Leeds & Northrup appoints **Edwin D. Scutt** and **S. Byron Morehouse,** assistants to the vice president-marketing. **G. D. Fowle** is the new head of the power section. **T. W. Hissey** succeeds Morehouse as head of electric power group, and **P. R. Whitten** heads the steam power group.

Burndy Corp has assigned assistant chief engineer **Herman R. Buttner** to its European subsidiary, Burndy Electra S.A. to train company representatives in European cities in technical aspects of connector applications.

Frank M. Rea and **John H. Hagen** has been appointed to newly created administrative posts "designed to strengthen inter-divisional activities of Minneapolis-Honeywell's industrial products group." Rea who was manufacturing operations manager, and Hagen, industrial relations director, will assume similar duties on an expanded basis and in an advisory capacity. **William B. Shellenberger** will serve as assistant to Hagen.

Westinghouse Electric Corp has made the following appointments: **William R. Ellis,** manager of a new special atomic project department; **Rhule L. Bell,** superintendent of the manufacturing and repair division plant, Compton, Calif.; **J. E. D. Morris,** manager of the Phoenix, Ariz, manufacturing and repair facilities; **William B. Harper,** sales manager of inside apparatus and supplies; **Bruce A. Everly,** manager of marketing for the lighting division; **Thomas J. Farrahy, Jr.,** assistant to the director of advertising; **A. Dwight Lynch,** national sales manager, specialty products, Westinghouse Electric Supply Co; **John I. Hoffecker,** product engineer for the power transformer division; **Carlyle W. Miller,** manager of San Diego apparatus office; **Millard A.**

(*Continued on p* 138)

Adds years of service life to old poles

Treated wood poles as offered by the wood preserving industry are one of the best investments a utility can make. Protect this investment with a planned pole inspection program and ground-line treatment with Chapman Pol-Nu to replace normal preservative depletion.

POL-NU is a superior grease-type preservative containing a full 10% PENTAchlorophenol. Performance records indicate proper treatment should result in at least 15 years of additional pole life. Economy of treatment is achieved through use of the Pol-Nu Bandage-Maker, illustrated below.

Uniform, accurately measured coating of Pol-Nu is automatically applied to paper backing to form a pole bandage of required length as needed, in the field.

Preservative bandage is wrapped around the cleaned pole, may be applied immediately without waiting for wood to dry.

Write today for complete facts

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and Pol-Nu Bandage-Maker

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Leading manufacturer of wood preservatives

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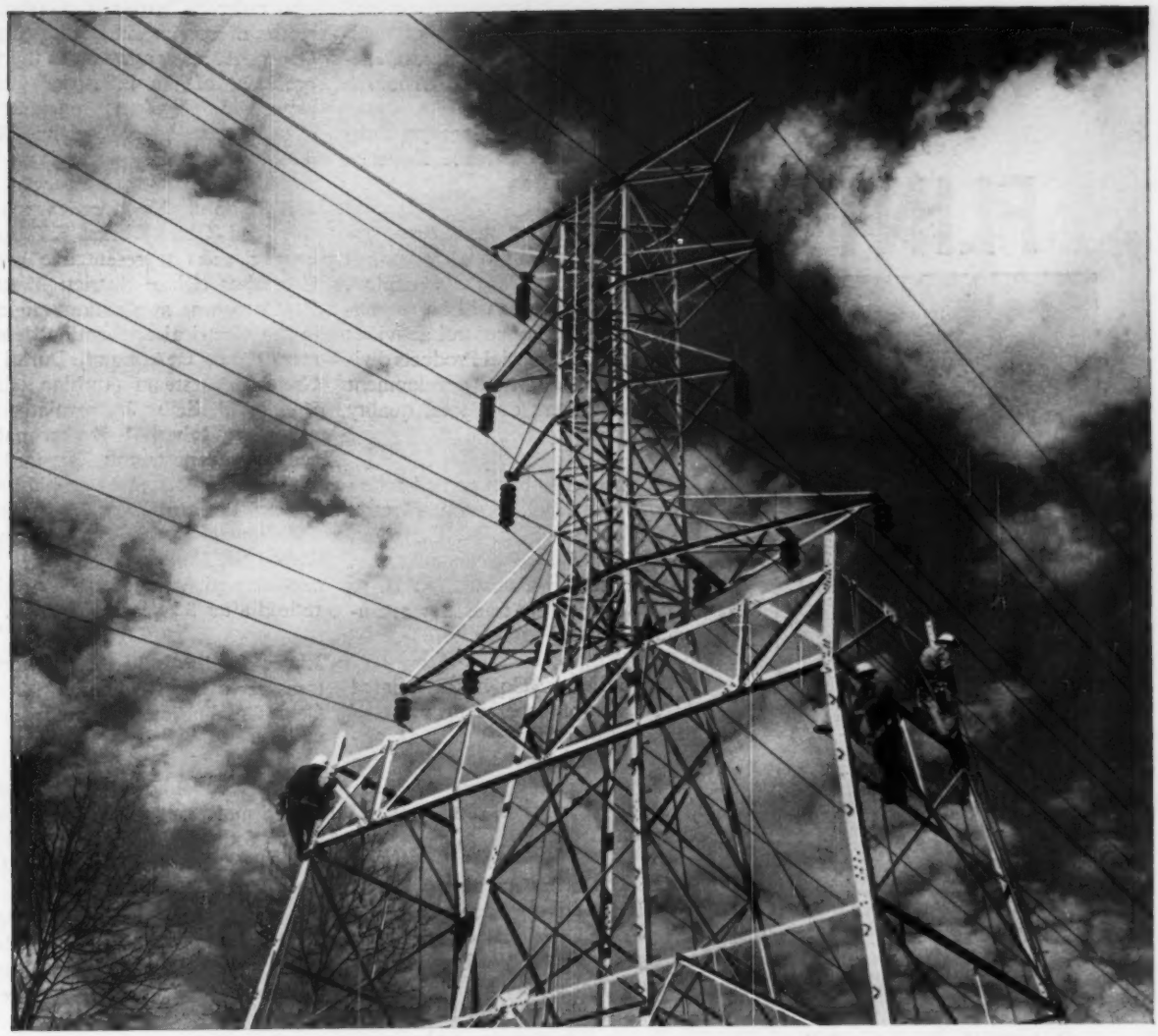
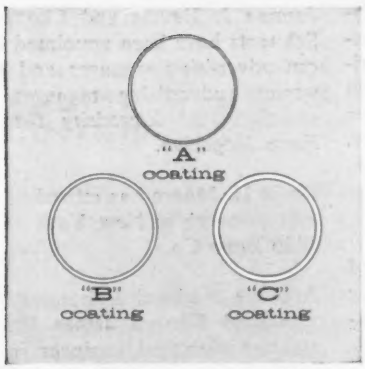


ACSR Core Wire Keeps High-Wires High



Bethanized Core wire is available in 3 coating weights.

Bethlehem ACSR core wire is the backbone of these high-tension wires. Built to withstand stiff winds and heavy weather, it furnishes dependable reinforcement and excellent corrosion-resistance when stranded into standard aluminum electrical conductors.

Manufactured to meet the latest ASTM specifications, Bethlehem core wire is available in three weights of Bethanized coatings. Bethanizing, our unique electrolytic process for coating steel wire with pure zinc, makes it possible to supply a coating weight double or triple the standard amoun: of zinc.

Commonly furnished in sizes ranging from 0.1878-in. to 0.0661-in., it is shipped in coils of one continuous length. Coil weights are in accordance with ASTM specifications. The manufacture of ACSR core wire requires close attention to steel making practices and wire mill processes and is followed by careful inspection and testing.

A phone call to your nearest Bethlehem sales office will bring you further information on any of your wire needs. Or write us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

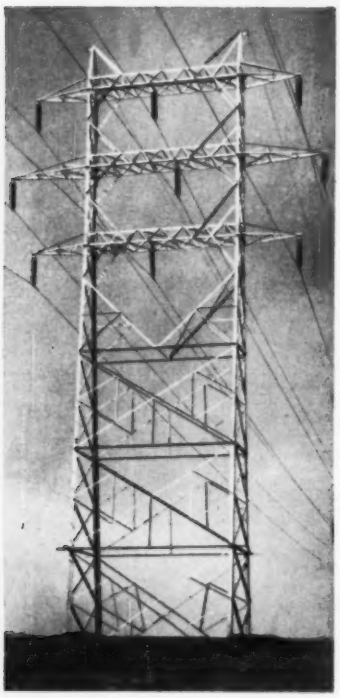
BETHLEHEM STEEL

BETHLEHEM STEEL

TOWERS

by

FLINT



Include:

A quality product, economically priced, produced to meet your requirements by the latest in manufacturing methods.

STEEL IS AVAILABLE

Competitive Delivery Anywhere
Your inquiries are invited . . .

FLINT STEEL

TULSA, OKLA.

MEMPHIS, TENN.

Nelson, engineering consultant, and **Roland L. Coit,** manager of engineering, heat transfer apparatus department for the steam division.

Stone & Webster Engineering Corp has named **F. Lawrence Doherty,** personnel manager.

William F. Hurst has been appointed director of quality control of the Leach Corp's Compton, Calif., facilities. He will be responsible for all quality control activities at the Inet and Special Products divisions, including the development and management of a total quality control plan.

Urcle Sheets has been named acting manager of the Sprague Electric Co's West Jefferson, N. C., plant. **Robert Parrish,** former manager, has returned to Concord, N. H. to take charge of the transistor manufacturing plant.

General Electric Co has appointed **W. D. Dance** general manager of its dishwasher and disposal department. **Thomas M. Linville** of the GE Research Laboratory has been named a member of the National Research Council.

Square D Co has appointed **C. M. Michalski** as corporate advertising manager. Divisional advertising managers are: **G. W. Pasdirtz** for the industrial controller division in Milwaukee; **R. A. Milo,** EC&M division in Cleveland; and **Nord** Froehlich, distribution equipment division in Lexington, Ky.

John B. Glenfield, Jr., has been appointed to assistant to the treasurer-project coordinator for Triangle Conduit & Cable Co. **Milton W. Gunkle** has been named director of purchases, and **Walter W. Banker,** in charge of production, planning and coordination department.

Robert F. Meehan has been named product sales manager for electronic chemicals in the inorganic chemicals division's marketing department of Monsanto Chemicals Co.

Allis-Chalmers Mfg Co has made the following appointments: **N. W. Morelli,** works manager in Pittsburgh, succeeding **D. G. McArn** who retired; **Charles R. Gibbs,** director of service, industries group; **George A. Saar,** assistant to the vice president of the industries group; **Ernest J. Wallner,** engineer-in-charge of project section, and **Raymond N. Sutphin,** supervisory engineer; **F. Nicholas Grasberger, Jr.,** and **I. John Niemkiewicz** to the Norwood (Ohio) Works; **T. F. Armbruster,** sales representative in the Columbus (Ohio) district; **Maurice F. Corcoran,** application engineer in the electrical application department; **Max DeArmond, Darrel D. Greenwell,** steam turbine dept; **Rodney D. Selby Jr,** regulator department; **Robert R. Burke,** motor-generator department; **Zygmunt A. Wachta,** development engineering section, Boston Works; **Mark Healy** and **John H. Noble,** nuclear power dept; **J. B. Hodtum,** manager of the central engineering department has retired after 35 years of service.

Elmer E. Barth has been elected treasurer of the Rockbestos Wire & Cable Co, division of Cerro de Pasco Corp.

John W. Hutchinson, Jr., has been named motive power market supervisor of the Exide Industrial Division, Electric Storage Battery Co.

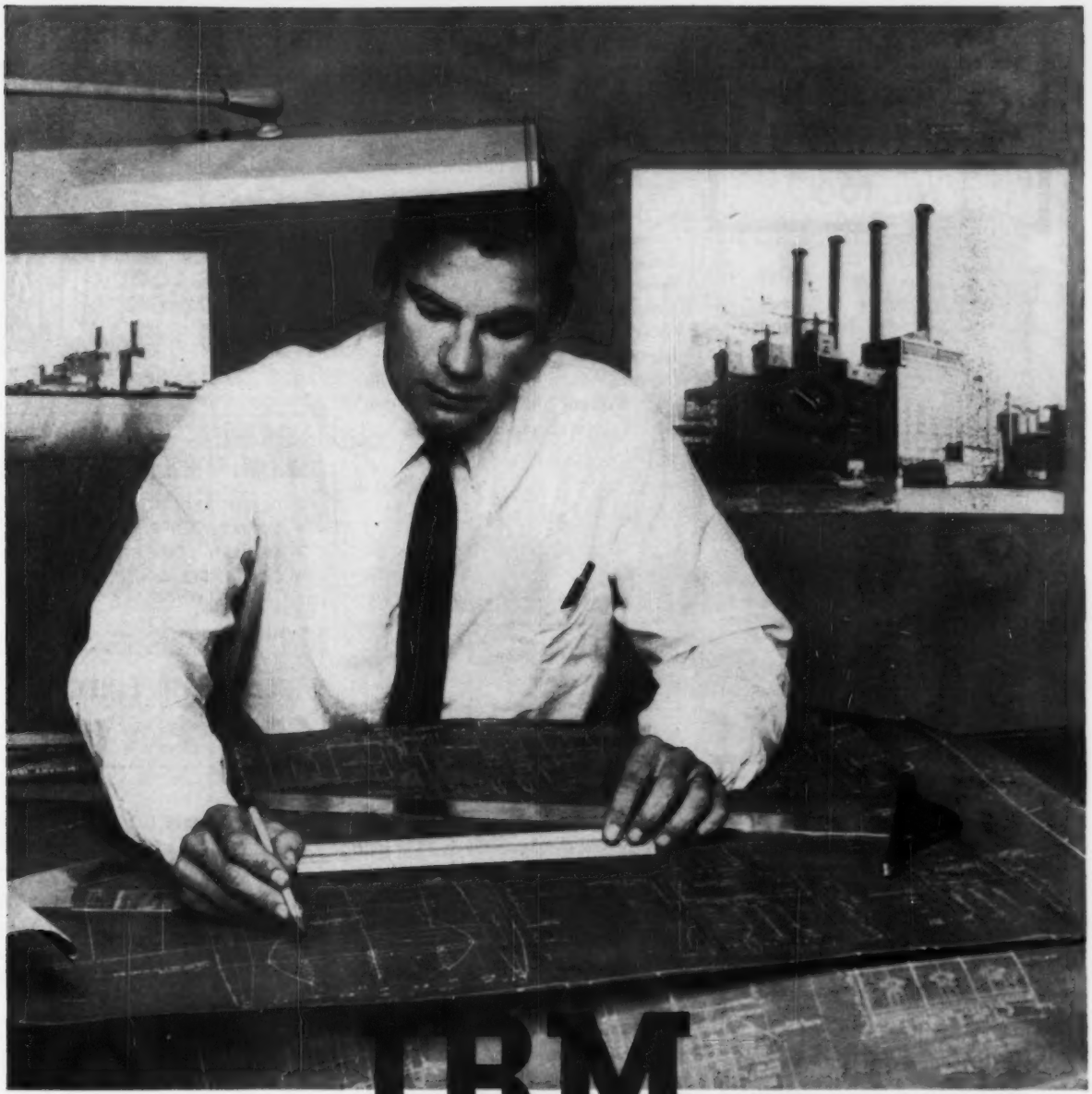
George F. Placier, Jr., has been named assistant sales manager, **Raymond Huckstein,** product manager-underfloor raceways; and **Walther H. Heer, Jr.,** product manager-busways at the National Electric Division, H. K. Porter Company, Inc.

Jerome J. Devers and **Clayton J. Schwartz** have been appointed eastern advertising manager and midwestern advertising manager, respectively, of *Electricity On The Farm Magazine.*

David H. Moore has retired as district manager in New York of the Ohio Brass Co.

Argonne National Laboratory has appointed **Edward James Brooks,** assistant electrical engineer in the Idaho division, and **Charles William Potts** assistant electrical engineer in the remote control engineering division.

(*More News About People, p* 140)



IBM COMPUTERS AID IN POWER PLANT DESIGN, CONSTRUCTION AND OPERATION

Today, IBM digital computers are finding wide application in the design, construction, and operation of generation facilities.

The design of access roads, calculation of coal-pile volumes, and the computation of moment distribution problems due to floor loadings represent typical examples of IBM computer usage. Within the power plant itself, IBM digital computers are tackling the significant problems of piping flexibility calculations, turbine heat-rate computations, and bus stress analyses. As a result, engineers are freed from laborious calculations and are able to devote more time to improved plant design, construction, and operating procedures.

IBM digital computers offer the power-generation engineers many advantages: problems formerly requiring hundreds of man-hours now done in less than one hour; more complete, "up-to-the-minute" calculations of plant performance with less chance of error.

Not confined to special purposes, IBM equipment can be used by both Engineering and Accounting Departments.

IBM's more than 44 years of service and experience are available to you through your local representative.

MINERALLAC
"PULL-IN"
COMPOUND
No. 100

LISTED and APPROVED by UNDERWRITERS LABORATORIES

For Rubber, Synthetic, Plastic or Lead-Covered Wires or Cables

Approved by Underwriters Laboratories for lubricating wires and cables to facilitate pulling them into conduits. Not injurious to wire or wire covers. Free of objectionable odors. White in color. Will not drip or run. Convenient pint, quart, ½ gal., gal. and 5 gal. cans. Available through your electrical jobber.

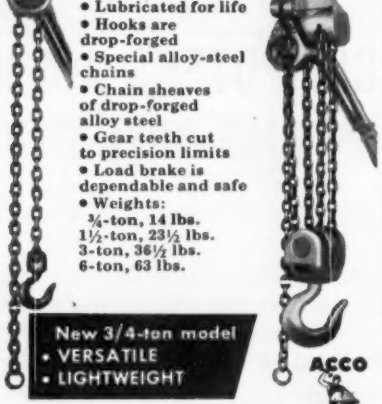
MINERALLAC ELECTRIC COMPANY
25 North Peoria Street, Chicago 7, Illinois

MINERALLAC

NEW ¾-ton Pull-A-Way
Added to WRIGHT TYPE "C" LINE!

FOUR SIZES • ¾, 1½, 3 and 6 Tons

FEATURES
- Lubricated for life
- Hooks are drop-forged
- Special alloy-steel chains
- Chain sheaves of drop-forged alloy steel
- Gear teeth cut to precision limits
- Load brake is dependable and safe
- Weights:
  ¾-ton, 14 lbs.
  1½-ton, 23½ lbs.
  3-ton, 36½ lbs.
  6-ton, 63 lbs.



New 3/4-ton model
• VERSATILE
• LIGHTWEIGHT

ACCO

Write to York, Pa., office for complete information

Wright Hoist Division
AMERICAN CHAIN & CABLE
York, Pa., Bridgeport, Conn.

Vincent P. Owens has been appointed assistant general sales manager in charge of industrial products at Combustion Engineering, Inc.

D. L. Pulliam has been named general commercial sales manager of Graybar Electric Co Inc.

Philco Corp has promoted **Jerome Spiegel** to contracts manager for its government and industrial division, succeeding **Conrad Young** who was named marketing manager for industrial products. **Frank Cohen** and **William Follensbee** were promoted to assistant contracts managers.

OBITUARY

Earl William Cashman, 68, former director and vice-president in charge of operations for Graybar Electric Co, Inc . . . **Ernest Chestnutt,** 70, retired chief inspector of Potomac Electric Power Co's Special Services Division . . . **Arthur A. Peck,** 63, distribution superintendent for the Indiana & Michigan Electric Co . . . **Raymond O. Martin,** 51, former member of the Ohio Public Utilities Commission, and a national authority on ratemaking . . . **Edward J. O'Neill,** 63, assistant secretary of Consolidated Edison Co . . . **Amory Edward Quinn,** 60, comptroller for Alabama Power Co.

George N. Hawley, 60, vice president of Southern California Edison Co . . . **Charles E. Ide,** 67, president and general manager of Toledo Edison Co . . . **Otto Pruessman,** 81, retired vice president of General Electric Co. He had been in charge of the firm's Far East operations for many years . . . **Wilfred C. Stephens,** 59, a former vice president of Niagara Falls Power Co . . . **William W. Ege,** vice president in charge of Copperweld Steel Co's wire and cable division and a director.

Charles B. Froehlich, 64, vice president and treasurer of Southern Indiana Gas & Electric Co.

Whether a Winch Line Hook or a complete Line Body check your requirements with

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HELICOPTERS FOR EFFICIENCY IN LINE PATROL AND INSPECTION

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To the man on the route slip . . .

. . . the $6 you save —Is it worth it?

- Stacks of dog-eared copies piling up on your desk . . .
- The chore of trying to carve out time to read in the midst of office pressures . . .
- The risk of missing something important you should know about today . . .

The coupon below will bring you 52 weekly issues of Electrical World directly to your home. You can pay the $6 later.

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HA-3

SALES ASSIGNMENTS

COMPANY STAFFS

Daystrom-Weston Sales Division, Daystrom, Inc, has opened two new branch offices and a new district sales office. New district sales office in Seattle, Wash., will service the Northwest market area. Ross K. Patterson has been appointed manager. Jess S. Smith has been made manager of a new branch office in New Orleans which is responsible for sales-engineering services in the New Orleans-Mobile area and will be supported by the district sales office in Houston, Tex. Carl G. Ketel has been named manager of a new Cedar Rapids branch office which will service eastern Iowa, Moline, and Rock Island, Ill., and will be supported by the Chicago district sales office.

REPRESENTATIVES

Sola Electric Co has named Hayes & Noe sales representatives for the lighting transformer line. The firm will cover the states of Georgia, Tennessee, Alabama, North Carolina, South Carolina, and western Florida. Hayes & Noe will be located at 1929 Buford Highway, N. E., Atlanta 9, Ga.

Radio Corp of America appointed the following manufacturer's representatives for mobile radio equipment: Spiteri's Electronics, Erie, Pa., Radio Communications Service, Evansville, Ind., Frosch Theatre Supply, Inc, Minneapolis, Minn., Communications Sales, Inc, Youngstown, Ohio, and Electronics Speciality Co, Charleston, West Virginia.

Bradley Company, Inc, who represents American Electric Switch Corp, Anchor Manufacturing Co, Burndy Corp, G&W Electric Speciality Co, Kyova Fiber Pipe Co, Minerallac Electric Co, Penn Panel & Box Co, S&C Electric Co, Standard Transformer Co, Thompson Electric Co, and Utilities Service Co, has established a Richmond, Va., office. G. B. "Brad" Peaseley, V, is manager and will be located at 601 East Franklin St., Richmond 19, Va.

I wish we had more personnel and time to prepare this study for a new power plant and site.

Your regular staff is overloaded now. Call in the specialists and let them carry the peak load. How about Pioneer?

Give your non-routine operations to Pioneer

Design and Consulting Engineering Services. Pioneer has specialized in designing power plants for 57 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters. Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

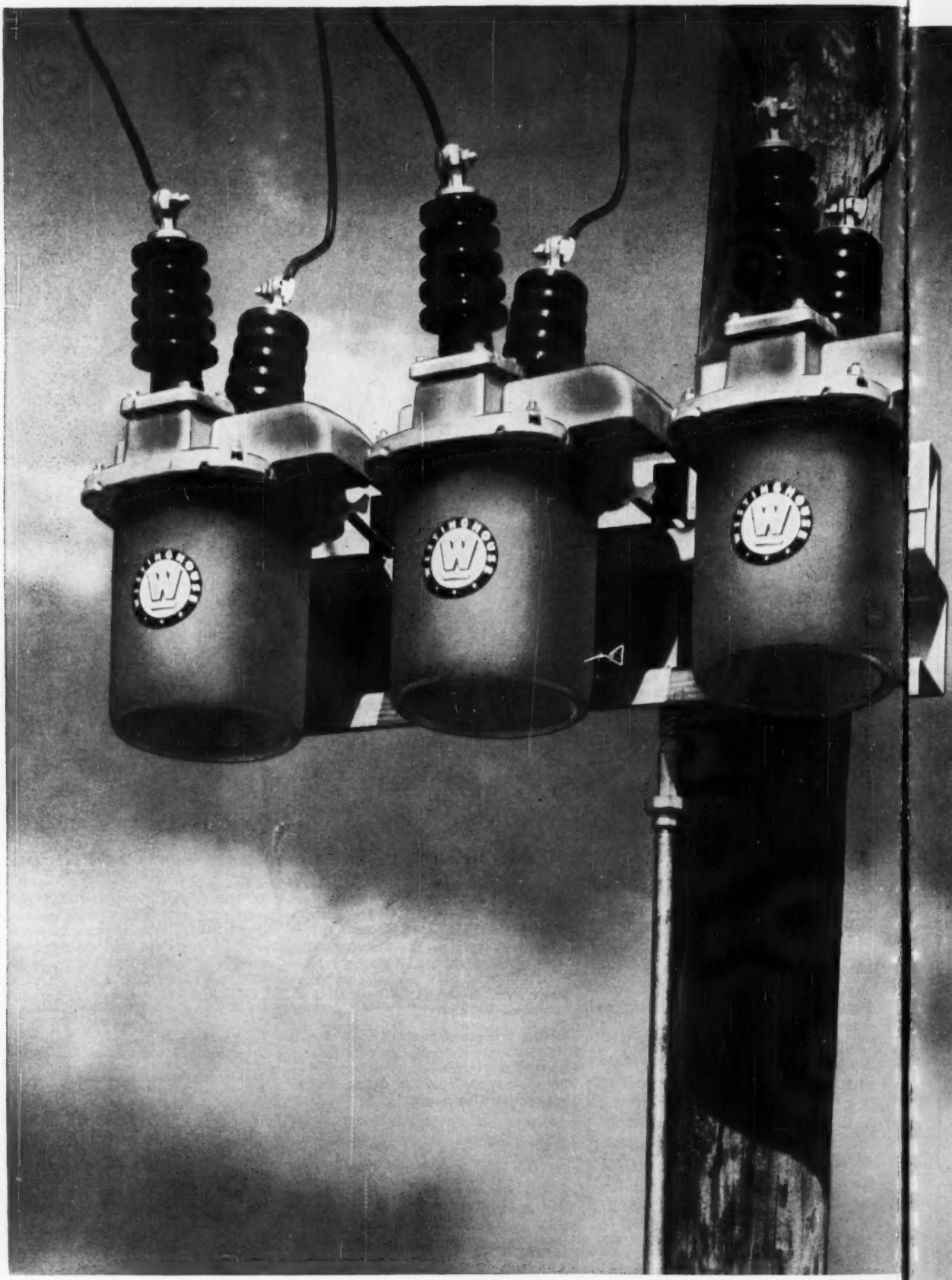
Corporate Services. Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!
On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes Pioneer's engineering services, and corporate services, from financing to operation.

57 YEARS

Pioneer Service & Engineering Co.

231 SOUTH LA SALLE STREET, CHICAGO 4, ILLINOIS

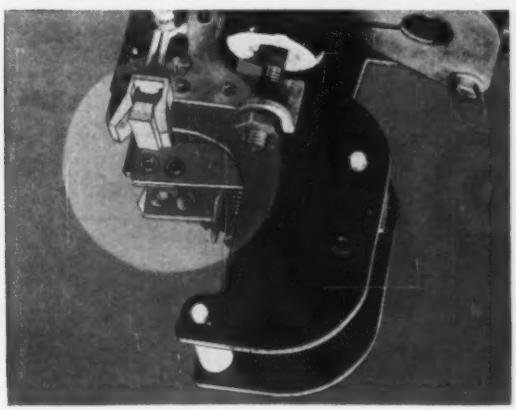


NEW WESTINGHOUSE CSL OIL SWITCH GIVES LONGER SERVICE LIFE, LOWER MAINTENANCE

The new 200-amp, 15-kv CSL embodies design advances which make it your best switching buy for pole-mounted capacitors, sports field lighting, street lighting, and sectionalizing applications. Improved thermal capacity, larger bushings with greater creep distances, increased dielectric strength of operating coils, finger-type contacts, and higher ratings are but a few of the CSL's outstanding features.

Faster closing contacts with positive wiping action

Initial contact is always made on the tips of the contacts, which are wiped clean as the closing cycle is completed, minimizing resistance even after repeated operations at maximum ratings. When the CSL is in the fully closed position, the current path is through surfaces of the contacts that are never subjected to strike. Contact speed has been increased to a minimum of 10 feet per second, helping to avoid reignitions and restrikes during capacitor switching. Moving and stationary control contacts are supported by a common member (see photo below), reducing alignment adjustments.



Solenoid-operated switching for fast contact opening

In addition to manual operation, the CSL switch offers the industry's only solenoid-operated switching for fast (2 cycle) contact opening. This quick response assures simultaneous operation of all three switches on a three-phase capacitor bank and prevents neutral shift and resulting high voltage to ground.

Longer life, lower maintenance

Control contacts are mounted above the oil, eliminating oil carbonization, reducing maintenance, and giving long, trouble-free service. Although the CSL switch has a guaranteed life of 10,000 operations, units have operated in excess of 30,000 times.

Let us show you how these higher-efficiency Westinghouse CSL oil switches can mean real dollars saved in your system. Call your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60987

RATINGS

voltage:

Nominal system voltage: up to 14,400 volts
Maximum design voltage: 15,000 volts
Basic impulse insulation level: 95 kv BIL
Control voltage (electrically operated switches): 120 or 240 volts

current:

Thermal rating: 200 amperes continuous
Momentary rating: 9000 amperes rms asymmetrical
Short time rating (1 second): 6000 amperes rms symmetrical
Maximum inrush current rating: 12,000 amperes peak

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

Books

Updates Physicist's Approach

Physics of Electricity and Magnetism. By William Taussig Scott. Published by John Wiley & Sons Inc, 440 Fourth Ave, New York 16, N. Y. 651 pages, illustrated. Price $8.75.

Besides its rigorous presentation of the basic theory of electricity and magnetism, the book offers an atomic approach to metallic conduction and the production of chemical and thermal *emfs.* Especially written for the junior-senior college level and for first-year graduate students, and presuming a grounding in differential and integral calculus, the treatment puts primary stress on the force rather than the energy point of view as the better starting point for training physical intuition.

Cable Spans Ocean

The Atlantic Cable. By Bern Dibner. Published by Burndy Library, Norwalk, Conn. 96 pages, illustrated. Price $3.50 in cloth, $2.50 in paper.

Latest in Dibner's series on the history of engineering is this very interesting and beautifully illustrated account of early attempts to extend telegraph service across the Atlantic. As ambitious a project when it was conceived 105 years ago, perhaps, as nuclear power today, it required over 13 years of cooperation between two nations and a series of companies to bring it to a successful conclusion.

Utility executives and engineers could profit from reading this saga of a sister industry. It abounds in human interest with which to embellish speeches to the public. And it will help nurture faith that perseverence will overcome today's obstacles.

New Electronics Reference

Industrial Electronics Handbook. Edited by W. D. Cockrell. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36, N. Y. 1,408 pages, illustrated. Price $22.50

This new reference book, prepared by a staff of 100 specialists, is an unusual compilation of material on all facets of industrial electronics. Approximately half the book is given over to a comprehensive treatment of the principles of mathematics, statics, and electronics needed for a basic understanding of modern industrial installations. The remainder covers such specific subjects as high frequency heating, welder control, voltage and power regulation, and motor control. Noteworthy are sections on tracer control, industrial radiation techniques, process control, and other new production processes. These are supplemented by brief surveys of analog and digital computers, recording instruments, and the patent system.

This book should be of great value to utility sales engineers and to both power and production engineers in industry.

Books Recently Received

Introduction to Nuclear Power Costs. By Arnold Rochman. Published by Simmons-Boardman Publishing Corp, 30 Church St, New York 7, N. Y. 57 pages, illustrated, paper bound. Price $2.75.

Analytical Transients. By T. C. Gordon Wagner. Published by John Wiley & Sons Inc, 440 4th Ave, New York 16, N. Y. 213 pages, illustrated. Price $8.75.

Tube Semiconductor Selection Guide. By Th. J. Kroes. Published by Philips' Technical Library, Gloeilampenfabrieken, Eindhoven, Nederland. 160 pages, illustrated.

Physical Laws and Effects. By C. Frank Hix, Jr, and Robert P. Alley. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, New York. 291 pages, illustrated. Price $7.95.

Electrical Measurements, Fifth Edition. By Arthur Whitmore Smith and M. L. Wiedenbeck. Published by McGraw-Hill Book Co, 330 West 42nd St, New York 36, N. Y. 302 pages, illustrated. Price $7.50.

A Simplified Technique of Control System Engineering. By G. K. Tucker and D. M. Wills. Published by Minneapolis-Honeywell Regulator Co, Brown Instruments Division, Philadelphia, Pa. 192 pages, illustrated.

Radioactivity Measuring Instruments. By M. C. Nokes. Published by Philosophical Library, 15 East 40th St, New York 16, N. Y. 74 pages, illustrated. Price $6.00.

Interference between Power Systems and Telecommunication Lines. By H. R. J. Klewe. Published by St. Martin's Press, Inc, 103 Park Ave, New York 17, N. Y. 221 pages, illustrated. Price $12.50.

Materials for Nuclear Reactors. Edited by Bernard Kopelman. Published by McGraw-Hill Book Co, 330 West 42nd St, New York 36, N. Y. 424 pages, illustrated. Price $12.00.

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Steel Tower & Wood
Transmission Lines
Distribution & Maintenance
175 Enfield St. Hartford, Conn.

COMMONWEALTH SERVICES INC.
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300 Park Ave.
New York 22, N. Y.

ASSOCIATES INC.
Consulting and Design Engineers
209 E. Washington
Jackson, Michigan

ELECTRICAL TESTING LABORATORIES, INC.
Electrical, Electronic, Environmental, Photometric and Chemical Laboratories, Testing, Research, Inspection and Certification.
2 East End Ave. New York 21, N. Y.

HOOSIER ENGINEERING COMPANY
Erection and Maintenance of Electrical Transmission and Distribution Lines
1350 Holly Ave., Columbus 16, Ohio

JENSEN, BOWEN & FARRELL
Engineers
Appraisals—Depreciation Studies—Property Records
Cost Trends—Special Studies—Reports for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Michigan Theatre Building Ann Arbor, Michigan
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TIPPETT & GEE
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EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

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RELAY TEST ENGINEER

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P-2448, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36,N.Y.

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Wanted by Leading Manufacturer of High Voltage Fuses and Interrupter Switches. Employment permanent with definite opportunity for promotion. Good salary, insurance and pension program. E. E. degree desirable but not essential. Send detailed resume of experience.

P-2776, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

RELAY ENGINEER

Recent graduate engineer preferably with some experience in electric utility, interested in protective relaying and automatic control of generating and transmission stations; capable of assuming responsibility on in-service checks on major electrical settings.

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CHICAGO, 11— 520 No. Michigan Ave. MOhawk 4-5800
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CLEVELAND, 13— 1164 Illuminating Bldg. SUperior 1-7000
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DALLAS, 1— 1712 Commerce St., Vaughn Bldg. RIverside 7-5117
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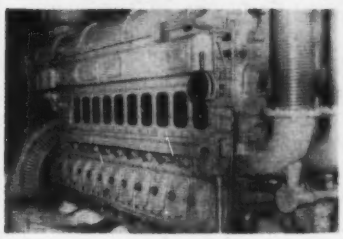
S. HUBBARD

Big Savings from Manufacturer's price

1000 kw FAIRBANKS-MORSE DIESEL ENGINE GENERATOR SETS



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Any standard voltage.
Immediate delivery from stock.

A. G. SCHOONMAKER *Company, Inc.*

Foot of Spring St., Sausalito, California
Edgewater 2-1490
50 Church St., New York 7, New York
Digby 9-4351

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TRANSFORMERS
NEW • REBUILT

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WORLD'S LARGEST INVENTORY
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SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Wanted—Graduate Electrical Engineers— Electric Utility in North Jersey area. Some experience in transmission and distribution desired. Please answer giving education, experience and salary expected. P-2345, Electrical World.

SELLING OPPORTUNITY OFFERED

Representative wanted for manufacturer of street lighting equipment pole line specialties. Full particulars. RW-9821, Electrical World.

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Bring You HIGH SPEED In 6x6's!

GMC—MACK—
REO "EAGER BEAVER"

LOW, LOW PRICES! GUARANTEED!
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• Complete Parts Stock! • Immediate Delivery!

AT LAST—High Speed combined with power, outstanding performance, rugged get-up-and-go—bring you everything you've been looking for in a truck!

And what a selection! Whatever your job, here's the truck for you. **The rough and ready Mack! The powerful, rugged GMC! The outstanding Reo "Eager Beaver!"** Each model the latest, most advanced truck engineering available today—at prices so low it's hard to believe. All with steel cab kits.

Contact us, too, for the complete line of unused army trucks!

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3—1000 kva Standard, 1/69000/4160Y/2400
3—1000 kva Standard, 1/34400/480
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PSC Splits Accounting for Consumers' A-Plant

Normal depreciation applies for cost of conventional plant of equivalent output; excess cost to be written off

Consumers Power Co has received an order from the Michigan Public Service Commission on how the company should handle accounting costs for the boiling water reactor plant to be built near Charlevoix, Mich. It will produce at least 50 eMw and possibly as much as 75 eMw.

The estimated cost of the plant will be $24,840,000 which will be split into two segments for accounting purposes. One, the commission said, is the cost of a conventional plant of equivalent capacity which will be depreciated in a normal manner. The other is the excess over the cost of the conventional plant which the company proposes to write off to operating expenses over a period of years.

Alternative Size Is 200Mw

The computed cost of a conventional plant of 75 Mw is $14,604,000. It is based upon 75 Mw being 37½% of 200 Mw, which would be the conventional plant size that the company would build as an alternative at this site. Deducting the $14,604,000 from the $24,840,000 leaves $10,236,000 excess cost.

PSC authorized the charging of the excess cost initially to the "Other Deferred Debits" account up to a maximum of $12 million. If this total is $10,236,000, it will be written off by the end of 1970.

Other Costs Are $5.3 Million

In addition the company will have the following additional elements of costs:

- Necessary plant substation and transmission lines of $1,250,000;
- Fabrication cost of first load of nuclear fuel of $1,594,000;
- Fuel research of $2.5 million.

These additional costs amount to $5,344,000 and brings the total cost of the plant to $30,184,000. The commission ruled that the $1,250,000 for substation and transmission costs will be depreciated over the normal service life of these facilities. The fabrication cost of $1,594,000 for the first load of nuclear fuel will be treated as a materials and supplies item and written off to expense as used. The fuel research cost of $2.5 million will be charged off to expense over a period ending in 1965.

The commission further authorized the continued writing off of contributions to Power Reactor Development Co at the rate of $500,000 per annum through 1962 and to Atomic Power Development Associates, Inc, at the rate of $150,000 per annum through 1962. The company also got PSC approval to write off the PRDC note guarantees at the rate of $188,000 a year from 1960 through 1968 and $185,000 in 1969.

Project Is 'in the Public Interest'

The PSC in its order said that Consumers Power Co . . . "has the responsibility to engage in research and development work directed to the attainment of the commercially competitive use of nuclear materials in connection with the generation of electric energy . . . and that the construction of the proposed reactor was . . . desirable and in the public interest . . ."

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76. To use a new powdered paint the object to be coated is heated and dipped in the powder which melts and adheres in a film.

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77. A new solution for photographic developing replaces three solutions now commonly used and is said to reduce development time to six minutes.

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85. Plans have been made for a nuclear-powered blimp which could be in operation by 1963.

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86. A pocket-size hi-fi tape recorder is battery operated, weighs only three pounds and can be carried in the pocket.

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87. A new application of ultrasonics is a device that drives rats away with sounds inaudible to humans.

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88. A solar generator is being used to charge an electric fence. It has a battery for use on dark days.

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Placement of the first deep-sea telephone cables linking the New World directly with continental Europe have been successfully completed by two cable-ships including HMTS Monarch, shown here at the Simplex Wire & Cable Co. docks at Newington, New Hampshire.

The new, 2,400-mile twin-cable trans-atlantic system, recently placed in public service, will provide thirty-six voice circuits between the U. S. and continental Europe.

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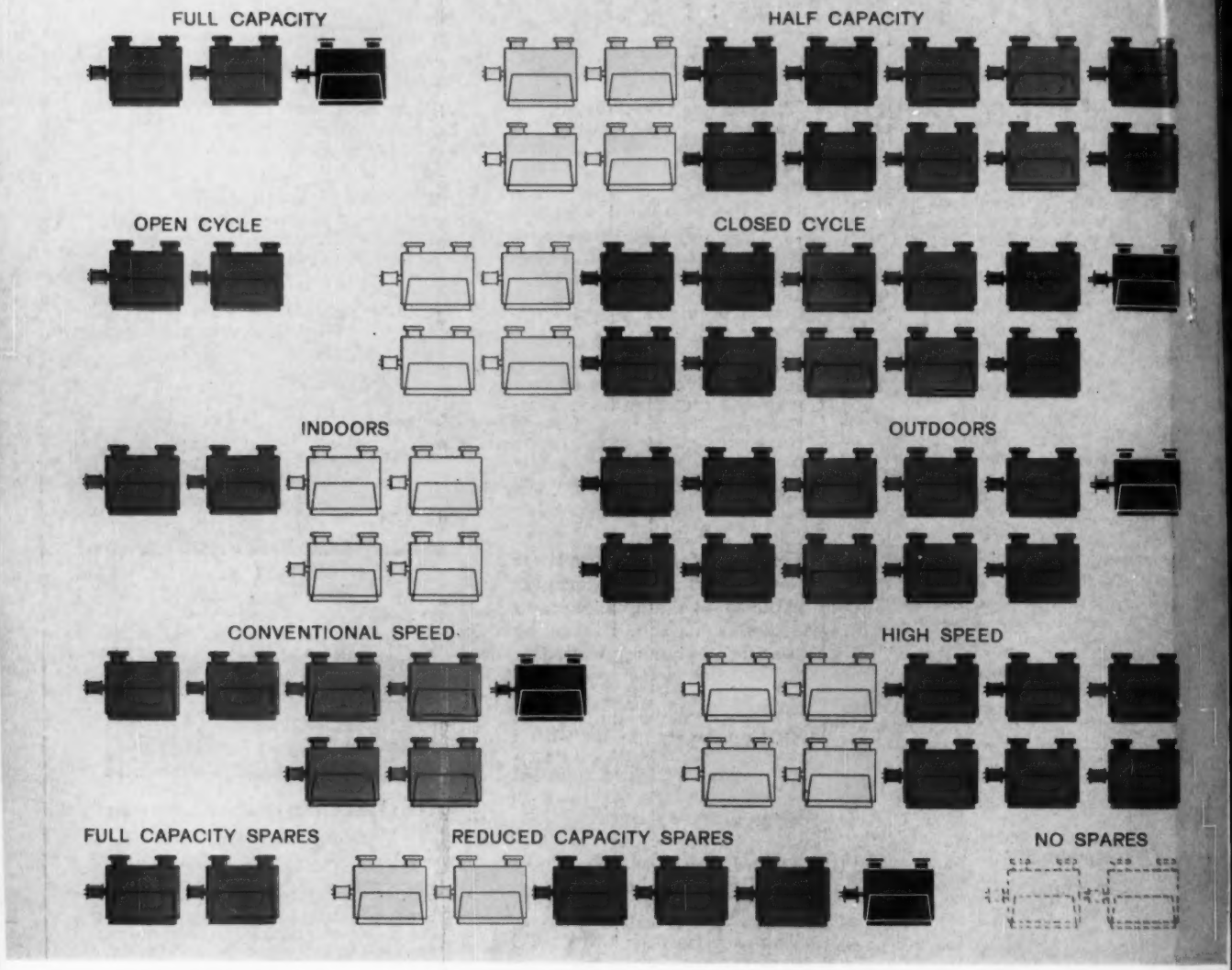

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For a copy of "Economics of Main Turbine Drives," write to Worthington Corporation, Section 45-11, Harrison, New Jersey. Ask for RP-931.

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